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THE FUTURE DEVELOPMENT OF THE FIELD VETERINARY SERVICES IN INDIA

AT the last meeting of the Animal Husbandry Wing of the Board of Agriculture it was hinted that the Indian Veterinary Services were failing to reach their goal, and it would be a confession of weakness to receive such suggestions either with careless unconcern or helpless dismay. For, if indeed the Veterinary Services have reached a state of stalemate, then the time is long overdue for a thorough ventilation of the whole position. Furthermore, during the same meeting earnest requests were made for concrete proposals for increasing the efficiency of all branches of the service and the present article is intended as a contribution to both these ends.

Considered in their broadest sense the Veterinary Services of India are a chain of communications starting with the collection of knowledge by the investigator, continuing with the impartation of this knowledge to the student or practitioner and ending with the taking of the knowledge to the field. Now, although this chain as a whole may be faltering, it cannot be denied that certain of its links are not only strong but are even rapidly becoming more formidable. Veterinary education, for example, despite minor disagreements as to standards and method is improving from year to year. Whilst, as for research, scheme after scheme is launched and completed and more and more knowledge is daily recorded. Clearly, therefore, these sections of the chain are not at fault and, in seeking a delicate link elsewhere, one is sooner or later struck by the appalling disabilities confronting the veterinarian as he tries to practise his profession in the baffling field conditions of India.

From the veterinary standpoint the difficulties of the Indian moffusil are twofold, *viz.*, difficulties of communications and difficulties concerned with technical methods in semi-tropical rural areas. At present, progress in overcoming these obstacles appears to be awaiting the stimulus of modern practice. Can it be said, for example, that the most highly educated Veterinary Assistant Surgeon posted in a small township is adequately equipped to deal with an outbreak of an unknown infectious disease twenty-five miles away? Can he, in point of fact, despite his modern education, collect a selection of the right apparatus at once, proceed to the outbreak more quickly, make a surer diagnosis and, having applied the right measures, be free sooner for other work than he could a quarter of a century ago? In all probability, no. With a few notable exceptions, he is almost entirely without diagnostic apparatus; he still has to await the railway company's pleasure until he can depart, or chance getting a seat in a bus. Alternatively, he can mount his bicycle, on which little or no delicate apparatus can be carried, and waste untold vital hours wearily plodding to the scene. In any case, he arrives, mentally and physically exhausted and usually has to spend a night away from his hospital, which is, perforce, left in unqualified hands. In this connection, it may be noted that animals are usually available for work in the early morning or at dusk only and, if the Veterinary Assistant Surgeon is dependent on present methods of transport, nights absent from headquarters are almost inevitable. Again, in the routine touring of his jurisdiction, so vital for getting truly in touch with the countryside and winning the confidence of villagers, he, a man trained for brainwork, must waste untold hours a year dulling his wits by pedalling a bicycle or by sitting at railway stations and bus-halts staring into vacancy. Clearly, the facilities for intensive and extensive field practice have not been developed side by side with increasing

competence, and indeed dearly-bought knowledge is being dissipated in the dust of communications.

It appears probable then, that India is not getting a proper return for money spent on veterinary education and research. In the meantime, serum for prophylaxis of cattle disease has already been transported by air in Africa; whilst medical officers are flown to emergency casualties all over Australia.

Modern Methods of Transport

The day of mechanisation has come and sooner or later every efficient field service will have to be motorised. Already, the Army Veterinary Corps is mechanised even for work in roadless Assam, whilst the lesson is clearly to be read from the veterinary practitioner in Europe and America, who simply could not survive competition without his motor car; from the commercial traveller who in olden times visited one town in three days by train, but who now triplicates his business by visiting two towns a day by car; while if further illustration be needed it can be found in every aspect of modern life.

The would-be economist will of course decry the cost, but facts must be faced and either a stagnating service must be endured, in which case the out and out economist would cut the cost of education and research also, or the money must be found. It is a remarkable fact that money can always be found for guns and so why not for butter, which unlike the former, in the long run, pays for itself in a prosperous and healthy community. It might well be added that despite anything that may be said in this article as to the actual modes and methods of advance, the one fundamental obstacle to progress in the past has been the lack of money for elaborating such schemes as are suggested here. The reactionary on the other hand will raise innumerable objections. He will say that India is not suited for motor transport, that the vast majority of villages do not lie on roads, that the Veterinary Assistant Surgeon is not "motor-minded", and so on *ad nauseam*. But history has almost always proved that reactionaries are wrong, and, although it is not suggested that the last word is being offered on the subject, the first half of this paper will be devoted to showing how mechanisation might be applied to the Indian Veterinary Services at the least possible cost and to the greatest possible purpose.

The writer has toured the Indian subcontinent from Cape Comorin to the Hindu Kush and from Bombay to Cuttack, almost wholly by self-driven motor-car, and one or two broad conclusions have been reached. The first is that a motor-car can go almost anywhere that a bullock cart can travel. Or in other words, with the exception of mountainous jungle and deltaic tracts, a suitable motor vehicle can reach most villages quicker than any other form of transport. Again, the motor-car makes the journey irrespective of time-tables; and will carry not only the veterinary officer but all the necessary apparatus and servants from the hospital door to the side of the field casualty. In consequence, it has been found that, whilst the ordinary touring veterinary officer expects, on the average, to visit one village a day for twenty days a month, the motor driver, if he likes, can reach from four to six villages a day every day of the month and in many cases spend his nights in comfort at home. He is, moreover, less tired at his journey's end, so that, whilst his visiting efficiency is increased sixfold, his personal efficiency is unimpaired. It is not surprising, therefore, that the writer has found that success in his own survey work of India has always been proportional to the availability of roads. It may be accepted then, that the efficiency of an officer is increased at least sixfold by the use of a motor-car for all routine touring work. But what of the emergency, the case in which speed will save lives of animals? Take, for example, the control of rinderpest; in most cases an officer equipped with a car can reach an epidemic centre within 100 miles radius in three hours or less whilst the same journey by other transport would take a day. Finally, there comes the question of prestige and advertisement. There is no doubt that smart work and efficiency command admiration and co-operation. A properly equipped motor-car or motor-cycle combination, properly used, would raise the prestige and influence of a veterinary officer enormously, for quick results inspire confidence, whilst delay breeds indifference or despair. In many cases, the over-tired Veterinary Assistant Surgeon arrives late on his bicycle and he can either make a guess at the diagnosis, and if he has it with him, apply the necessary remedy, or he can take samples for laboratory examination the results of which will be a week coming through. But in a week's time all animals that are going to catch the disease are already dead, the owner has forgotten the incident and the second visit of the Veterinary Assistant Surgeon with the remedy only serves to remind the cultivator of an unpleasant experience, in view of which he can hardly be expected to extend a welcome and give his remaining healthy animals for vaccination.

But, if the same work is done by car or motor-cycle, the Veterinary Assistant Surgeon arrives mentally vigorous at the earliest possible time and, having all the necessary apparatus with him, he completes a simple and certain diagnosis, injects the right serum or vaccine at once and is free for other work almost immediately.

It is not suggested, of course, that mechanisation can be applied equally all over the country, for some provinces are fairly well supplied with roads whilst others are almost entirely without. Nevertheless, if something is to be done at all, first things should come first and, because it is impossible to mechanise in say deltaic Bengal, that is no reason why it should not be done in the Punjab. Furthermore, if in a good cattle district well served by roads, it is found that certain quite large percentage of the villages cannot be reached by road, this is no reason at all why those that can be so reached should be denied efficient veterinary services. A start has to be made, even if it is only a small one, and having so

started and given satisfaction to the roadside dwellers, those distant from the roads will ask for satisfaction also and more roads will be made. As has been said before, motor transport has come to stay and, although some still appear to doubt it, it is no longer a luxury but an economic and commercial necessity. More village roads will certainly form part of post-war expansion and it seems quite evident that soon after the cessation of hostilities a modified motorised veterinary service could be introduced in the following Provinces: Punjab, N.-W. Frontier Province, U.P., C.P. and Berar, Orissa, Bihar, Bombay and Madras. Broadly speaking, good cattle- and sheep-breeding areas of these Provinces should receive the first attention.

Organisation of a Mechanised Field Service

Before passing on to some practical considerations of organisation, one or two wider points must be discussed and firstly comes the type of touring that are usual within a province. On the whole it may be said there are two, *viz.*, (1) short daily tours from a local centre within 25-50 miles radius and (2) continuous tours from a provincial or divisional headquarters. The former would be in the hands of the Veterinary Assistant Surgeons or better still a specially trained Mechanised Veterinary Officer and in this case there would be a tendency to divide the cost by giving the District Board some share in the organisation. It would be fatal, however, to permit an unprofessional body to have the slightest control over a technical service which, to achieve uniformity and efficiency, must be undividedly in the hands of the technical head of the provincial department. As for the second type of touring, certain reactionaries might still suggest that this can be better done by train, arguing that it is only on short journies that motor transport has such a marked superiority over rail. Nothing, however, could be farther from the truth, for the writer's experience has proved over and over again that the only journey that can be more efficiently made by train is the very long distance mail-train journey from province to province, and that, on the contrary, any journey up to 250 miles is done infinitely quicker by car. Furthermore, on a widespread provincial or divisional tour a car journey may be broken anywhere, irrespective of timetables, connections or stations; wayside halts at the side of grazing cattle can be made at will; diversions can be made on the spur of the moment, often without interfering with the dates of the tour programme, but above all, twice the territory can be intimately covered in the same time and with less fatigue. For all these reasons, therefore, a closer contact with the countryside is established.

The shape of things to come is foreshadowed by the vigorous provincial motoring of the original Veterinary Investigation Officers. Their work, however, as their name implies, has been mainly concerned with investigations about which there are few complaints. But the time has now come for developing applied veterinary science on similar lines and some suggestions to this end are offered in the following paragraphs.

Although bearing different names, the veterinary staff of most provinces is much the same and the work of the Deputy Superintendent, or his equivalent sub-divisional or district officer, merits first attention. As far as can be judged, the present duties of most of these officers consist of surprise inspections of the sanitary condition of hospitals, a forwarding agency for orders and regulations and sometimes receptionist work for visitors. Such an officer may have more than one district in his jurisdiction and an operational radius of up to 100 miles. At present, even for the light inspection duties mentioned above, it appears that a Deputy Superintendent can in some cases visit no more than one-fourth of his territory each year. Under the proposed mechanisation, however, each deputy superintendentship would be remodelled on the basis of motor transport, and the incumbent's main duty would be (*a*) the personal supervision of large-scale prophylactic therapy in the field, and (*b*) the organisation and control of various livestock improvement schemes. It must be recalled that in normal conditions he can reach almost any of his hospitals in less than three hours, taking with him all the necessary staff and equipment and he can leave night or day irrespective of outside influences. His motor vehicle would be permanently fitted up with diagnostic apparatus such as microscope, stains, slides, hand-centrifuge, slide agglutination materials, specimen bottles, etc., and he would be able to stock it within a few minutes with serum, vaccines, and therapeutics for the more usual infectious diseases. It must be emphasised that not even the lowest-qualified veterinarian, let alone the Deputy Superintendent, should be directly concerned with castrating schub bulls, filing of teeth, treating colic cases or such like stockman's duties, and the latter's work would be to see that he is informed by the former of serious outbreaks of certain scheduled diseases; to get to the outbreak in the manner of a flying squad; to diagnose the condition; to apply the remedy and to return as soon as possible to headquarters. Few outbreaks would require an absence of more than a day, for once prevention has been initiated the Veterinary Assistant Surgeon who would be picked up in passing could complete the work. On the Deputy Superintendent's return journey inspection work and follow-up calls could be made all along his route. During periods when diseases are rare this officer would spend his time scouring his jurisdiction, making friends with the cultivator, initiating propaganda work, organising livestock improvement schemes and giving advice.

The headquarters and jurisdiction of these officers would, if necessary, have to be resituated, solely with an eye to road communications. Headquarters, therefore, should be placed at cities on important road junctions, whilst, as far as possible, the limits of a jurisdiction would be determined by impassable river crossings or other natural barriers, and in this respect the possibility of temporary road-blocks due to monsoon flooding should not be overlooked.

Officers holding these appointments should be exceptionally energetic and as far as possible

have had special post-graduate training in field diagnosis and preventive therapy. They would have as an assistant a young post-graduate training in field diagnosis and preventive therapy. They would have as an assistant a young post-graduate trainee, ultimately intended as a recruit to the group of Mechanised Veterinary Officers shortly to be described, whilst future Deputy Superintendents would be drawn from men trained in this category.

Now although the ideal would be to motorise all officers below the office of Deputy Superintendent, this is manifestly impossible, at present at any rate. Indeed, in some provinces it might not be impossible to mechanise below this rank. But in others, and specially in important breeding districts, the mechanised Deputy Superintendent might be supplemented by a class of motorised touring veterinary officer or Mechanised Veterinary Officer. One province at least has already separated the touring officers from the hospital officers, which is an excellent arrangement as thereby hospitals are not left for days at a stretch in charge of compounders or stockmen and each class of officer can specialise in his own kind of work. Provinces that are able to proceed with mechanisation in this manner would grade their junior officers into Veterinary Assistant Surgeons in charge of hospitals. These men would be the least trained and except in emergencies would not make visits requiring an absence of more than a few hours from their posts. The other grade would be the touring veterinary officer consisting of selected post-graduate trainees and being as far as possible mechanised (Mechanised Veterinary Officer). A Mechanised Veterinary Officer situated at a headquarters again chosen for its road communications would be given a geographically suitable jurisdiction of say 25 to 50 miles operational radius. His duties would be (i) to supplement or join up with the work of the Deputy Superintendent, (ii) to diagnose and treat on his own account small epidemics in his own area and (iii) to take over from the Veterinary Assistant Surgeon of his territory all the routine touring which had previously necessitated their leaving the hospitals for more than a few hours. His car or motor-cycle combination would be fitted similarly to that of the Deputy Superintendent and as assistant he could carry a stockman who would attend to routine castrations and similar work.

It is not to be expected that even the richest provinces would be completely mechanised all at once, but in the post-war era there is almost certain to be a big disposal of army vehicles, which, as far as cost is concerned, might present an excellent opportunity for acquiring a nucleus of vehicles sufficient for the Deputy Superintendents and specialised work. Thereafter, one or more touring veterinary officers could be mechanised every year, depending on demand and the results of earlier experiences. Whilst on the subject of demobilisation, it must be recalled that many veterinary officers returning from the war would have wide experience of modern mechanised transport. Clearly, these men would have much of the initial training requisite for the work of a mechanised veterinary officer and could probably be diverted to these duties.

Suitable Types of Motor Vehicles

There can be no question but that for the Deputy Superintendent an American-made station-waggon, such as a Chevrolet or Ford, would be most suitable. These vehicles will carry an enormous amount of equipment besides several passengers. In normal times spare parts are available everywhere and every roadside "mistri" understands these reliable models. Nevertheless, whilst they will travel almost anywhere, especially if fitted with extra large sectioned tyres, for Deputy Superintendents situated in special areas a different car might prove more suitable. It is possible, for example, that, where the majority of touring would be in semi-desert tracts, a Willys Jeep would better fill the bill. Whilst, on bridle roads of hilly tracts either a Jeep or a four-speed low-geared 10 H.P. short chassis car, such as the Opel, might be more serviceable.

The Mechanised Veterinary Officer's vehicle would require more careful selection. For the sake of economy, it would be tempting, of course, to provide him with a cheap small horse-powered car such as a Ford 10 or a motor-cycle and sidecar and, where; as in Madras, roads are abundant, this would be sufficient. But in certain cases it might be better for the Deputy Superintendent to be provided with a station-waggon as a general purpose vehicle for his whole jurisdiction, and one of his Mechanised Veterinary Officers given a Jeep for work in a special tract and which the Deputy Superintendent could, if necessary, borrow. Such selections would have to be made on the advice of an officer with wide motoring experience throughout India.

Equipment

Equipment is the next consideration and clearly there are two kinds of field work that require apparatus, one is surgical or clinical and the other is diagnostic. Now it must be clear to every able thinker that the latter is by far the more important of the two, for manifestly, whilst each is indispensable, it is much better to be able to diagnose say an outbreak of anthrax and so save numerous lives than to carry out work of a clinical nature on individual animals.

It has already been seen how a touring officer, being unable to make a field diagnosis, must send samples to the laboratory with consequent delay. It now transpires that in many cases he has actually to write to the laboratory first to obtain the apparatus in which to take and transmit the specimen, thereby doubling his work and extending the period of delay into weeks.

In the past no doubt there has been an excellent excuse for this lamentable state of affairs, for owing to the fact that the duty of diagnosis has been divided among so many, it has been impossible to train and equip everyone sufficiently. The Veterinary Assistant Surgeon, therefore, has remained the jobbing surgeon and the guessing diagnostician. But it is now

apparent that by concentrating diagnostic work in the hands of a few Mechanised Veterinary Officers it is not only possible to increase the scope and speed of the work by means of the car, but it ought to be possible to train and equip the fewer men needed in a manner worthy of the duties they have to perform. As far as post-graduate training is concerned, a step has already been made in this direction, but the key step of mechanisation has so far not been developed, and the question of supply of diagnostic apparatus has not so far as is known been thought of.

The Mechanised Veterinary Officer's diagnostic work can be divided into two classes, *viz.*, direct, *i.e.*, the work he can do himself in his mobile laboratory and indirect, *i.e.*, cases where he has to send specimen for laboratory examination. It is clear, moreover, that in the cause of speedy diagnosis the direct method should be used whenever possible. Indirect diagnosis also includes specimens taken from cases diagnosed directly but which the operator desires to be sent to the laboratory for check. Direct diagnosis could probably be achieved in most of the better known infectious diseases and it might be useful to schedule these conditions and call for special reports on them. Indirect diagnosis would be needed in more obscure conditions which crop up from time to time in certain virus and poultry infections.

For direct diagnosis the first and foremost requisites would be a microscope, slides, and the more ordinary stains. With these and an ability to make satisfactory smears, it ought to be possible to recognise some of the everyday diseases. For the diagnosis of special diseases such as tuberculosis, all that will be required is a special syringe and some tuberculin; for contagious abortion and other diseases recognised by a simple agglutination test a glass plate, some antigen, a few pipettes, and so on. The packing and carriage of such articles is a simple matter and the room occupied in a car is negligible. Further, many provinces may already have sufficient microscopes to equip the few Mechanised Veterinary Officers and the cost of this apparatus would not, therefore, be great. Certain diseases can be recognised by means of a *post-mortem* examination and a suitable *post-mortem* kit would have to be included. A minor surgical kit and castrating instruments could also be carried for the stockman's use.

For indirect diagnosis the euipment would have to be rather more specialised, but it would be little more than elaborately prepared glassware, in the designing of which the advice of an experienced research officer familiar with field technique would be required. Such glassware would have to be properly packed, returned to and re-issued from the parent laboratory whenever samples had to be transported. In passing, it may be mentioned that there is a very wide scope for the use of the thermos flask; an article far from fully appreciated by the field service.

In conclusion, during the transition period, when a policy of jobbing surgery is being altered to one of mechanised state of diagnosis and control of epidemics, it appears that a field *liaison* officer might advantageously be appointed in one or other of the more important research institutions of this country. The duties of this offer, who would require a small staff, would be (1) to advise on mechanisation, (2) to train officers in practical field diagnosis and control, (3) to keep a record of the condition of indirect diagnostic materials coming into the various departments of the institute and, arising from this, to investigate the cause and correct the defects of systems of diagnosis, (4) to develop better methods of field diagnosis, mainly with the object of substituting direct methods for indirect methods, (5) to perfect field diagnostic apparatus and (6) to tour widely in conjunction with Mechanised Veterinary Officers in first one and then another part of the country.

J. B. POLDING.

DR. R. E. M. WHEELER, M.C., D.Litt., F.S.A.

BRIGADIER MORTIMER WHEELER whom we have pleasure in welcoming as Rao Bahadur K. N. Dikshit's successor was, before he went on active service to Tunisia, the Keeper and Secretary of the London Museum, Director of the Institute of Archæology in the University of London, and Lecturer in Archæology in the University College, London. Earlier he was in charge of Archæology in the National Museum of Wales, one of the most progressive among the larger museums of Great Britain. He is an outstanding member of his profession and has a wide range of experience in modern archæological excavation, the preservation of ancient monuments and the organisation of museums. He is a Fellow of the University College, London, Member of the Ancient Monuments Board for England and Wales, and a Governor of the National Museum of Wales. Dr. Wheeler's excavations of Bronze Age, early Iron Age, and Roman sites such as Verulamium, in England and in France are considered to be perfect examples of modern archæological technique. India, particularly Southern India, abounds in megalithic monuments, to which class of archæclogical remains Dr. Wheeler has paid special attention, and we hope that this branch of archæology will benefit by his knowledge.

Dr. Wheeler is known to be a man of active habits with a great capacity for friendship and team work, and we have no doubt that under his guidance the museum movement in India will be better organised than it is at present, and that Indian archæology will not only maintain the progress that it has made since the days of Sir John Marshall, but help to throw further light on the several unsolved problems connected with the story of India's past.

GLANDS AND GLAND PRODUCTS

III. The Chemical Assay of Desiccated Thyroid

BY
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THE results of certain analyses which were carried out in this laboratory on specimens of desiccated cattle thyroid are being recorded in view of the fact that they go to show that the directions given in the British Pharmacopœa (1932) for the desiccation of thyroid are not sufficiently specific. According to the B.P., the minced thyroid gland should be dried at temperatures not exceeding 60° and the dried solid treated for the removal of fat. We had occasion to compare the analyses of a few specimens of desiccated thyroid glands, when the drying was carried out both *in vacuo* and at ordinary atmospheric pressure, the tissues having free access to air in the latter case. A significant amount of difference was noted in the two cases and the analyses were, therefore, carried out on specimens dried also at high temperatures, both *in vacuo* and at atmospheric pressure. The defatting of the dried solid was always carried out with acetone, petroleum ether not being available at present in the market. The results of the analyses which are representd in the following table show conclusively that the figures for the percentage ratio Thyroxine iodine/Total iodine for any given temperature, is consistently higher by a small but definite fraction (see column No. 8) when the preliminary drying is carried out *in vacuo*, than when the same process is carried out in contact with air at ordinary atmospheric pressure. This would seem to indicate that minced thyroid tissue is susceptible to some extent to the action of air at the temperatures used for purposes of desiccation. Preliminary experiments at the actual isolation of thyroxine also go to show that the yield of thyroxine is distinctly higher when the desiccation of the gland material is done *in vacuo* than when it is effected at ordinary pressure.

It would also be evident from the table that with a particular mode of drying, i.e., either *in vacuo* or in contact with air, specimens obtained by drying at high temperatures (80-100°) do not analyse very differently with regard to their percentage of thyroxine-iodine content from those dried at low temperatures (40-60°). Since drying at high temperatures is, however, likely to cause denaturation of thyroid proteins, it seems to be essential that the results of chemical assay of commercial specimens of desiccated thyroid—desiccated thyroid is one of the few gland preparations whose assay is usually carried out *only* chemically—should be supplemented by biological methods of assay for assessing the correct potency.

	Cattle thyroid dried *in vacuo*			Dried at ordinary pressure in contact with air			
Temp.	Total iodine per cent.	Thyroxine iodine per cent.	Thy. I/Tot. I in per cent.	Total I per cent.	Thyroxine iodine per cent.	Thy. I/Tot. I per cent.	% difference between colms. 4 & 7
1	2	3	4	5	6	7	8
27°	1·003 1·016	0·4537 0·4444	44·69	Not possible to dry			
40°	1·064 1·046	0·4326 0·4279	40·79	0·9685 0·9752	0·3782 0·3854	39·28	3·844
50°	0·9461 0·9461	0·4130 0·4130	43·62	0·9991 1·021	0·3915 0·3915	38·77	12·51
60°	0·9877 1·007	0·4096 0·4048	40·83	1·032 1·028	0·4030 0·4052	39·23	4·079
70°	0·9028 0·9162	0·4230 0·4265	46·97	0·9982 0·9759	0·3995 0·3971	40·35	16·41
80°	0·9563 0·9372	0·4315 0·4199	44·95	0·9488 0·9385	0·3596 0·3738	38·86	15·67
90°	0·9590 0·9554	0·3897 0·3921	40·84	0·9949 0·9761	0·3588 0·3796	37·46	9·022
100°	1·021 0·9856	0·4078 0·4042	40·49	1·007 1·010	0·3677 0·3654	36·35	11·39

ZOOLOGICAL RESEARCH IN RELATION TO DEVELOPMENT OF FISHERIES*

By SUNDER LAL HORA, D.Sc., F.R.S.E., F.Z.S., F.R.A.S.B., F.N.I.
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IN inviting me to participate in a symposium on "Zoology and the Food Problem", our last year's President, Dr. B. N. Chopra, wanted me to elucidate "how zoological studies and research can help us in conserving, augmenting and utilising in the best possible way the fishery resources of India". My task has been made much easier by Dr. Chopra himself because in his Presidential Address, he brought out very ably the necessity and importance of scientific research in the development of fisheries. The members will also recall that at the Jubilee Session of the Congress held at Calcutta in 1938, the overseas and the Indian delegates of the Zoology Section reviewed the fisheries of the country in relation to food supplies and felt it necessary to urge upon the Government of India the desirability and "importance of constituting an All-India Department of Fisheries for the development of the fishery resources of Indian waters on scientific lines". The delegates were further of the opinion that, "unless development of the fishery resources of Indian waters is carried out with due regard to the scientific principles which form the basis of successful fishery developments, there will be grave danger of irreparable damage to the fisheries concerned". In commenting on the limited scope of the work done by the Fish Committee of the Imperial Council of Agricultural Research, Dr. Chopra advocated that—

> "Fishery research is a wholetime job and the problems connected with it are too numerous and too involved to be satisfactorily handled as a subsidiary activity of a section of the Imperial Council. Like agriculture, fisheries should have an Imperial Council of Fisheries Research under the scientific control of an expert Fisheries Officer, with a band of scientists working on its staff, with technologists trying to solve the difficulties experienced under varying conditions all over the country, with marketing experts always keen to devise means for better distribution and better utilisation, and with the whole body alive to the ideal of providing 'better food, more food, more and better fertilizer, better organization', and last but not the least, to the improvement in the moral and material conditions of the poor fishermen, for on his well-being will ultimately depend the prosperity of the industry."

Thus, it will be generally conceded that for the development of the fishery resources of India, there is an urgent necessity of undertaking scientific investigations on fishery problems by means of a carefully planned programme of co-ordinated scientific research, which, to be effective and efficient, should be controlled by one central authority for all India. I hope this Session of the Congress will also urge on the Government the necessity and importance of starting a central organisation for research in fisheries.

Nature of Fishery Investigations

Confining myself now to zoological research in relation to the development of fisheries, I wish to invite your attention to the remarks made by the late Dr. N. Annandale regarding the nature of fishery investigations. According to him, these may be considered conveniently under two heads, (*a*) biological and (*b*) human.

> "Under the head 'biological', attention must be paid to the physical environment of the fish; to the fish themselves, their species, their life-history, breeding-habits and food, their enemies and, in the case of rapacious fish, their prey.
>
> "Under the head 'human', one must take into account methods of capture, fishery statistics, fishery laws and customs, customs and regulations as to the sale of fish, prices, demand, even the character and social status of the fishermen."
>
> "In all fishery questions it is of the first importance that due consideration should be given to all of these points and neither the human side of the enquiry sacrificed to the biological, nor, as is more common, the biological to the human. Biological training does not give a man local experience; it may not even make him a good judge of character, but still less does local knowledge or administrative capacity enable a man to speak sensibly on technical subjects such as biology without profound study."—(*A Note on the Fisheries of the Inlé Lake, Southern Shan States*, Rangoon, 1917, p. 1.)

Zoological Studies and Fisheries

In the light of these observations, let us now analyse how zoological studies and research can help us in the development of fisheries.

Environment of the Fish.—We all know that environment plays an important role in the life of an organism and that its rate of growth, health, longevity, etc., can be greatly influenced by making suitable alterations and adjustments in its environment, both physical and biological. For increasing the yield of our fisheries, it is necessary, therefore, that all factors that constitute the environment of any particular species should be studied and their influence on its well-being elucidated. For instance, in European countries through the accumulation of a vast body of accurate knowledge regarding the hydrography of the seas, the chemistry and physics of sea-water, its circulation, currents, seasonal changes and fluctuations in the water, and the planckton, both animals and plants, and its annual changes,

* An article contributed to the symposium on "Zoology and the Food Problem" held by the Section of Zoology and Entomology of the Thirty-first Session of the Indian Science Congress, at Dehli, in January 1944.

rapid progress has been made in fishery science and most of the problems which the European fisheries present are now well understood. The problems of the marine fisheries of India are similar and, therefore, for their elucidation a study of all the ecological factors influencing changes in the fish populations is most essential. In the case of freshwater fisheries, it is well known that all pieces of water are not equally productive and that through manuring the tanks and artificial feeding of fish poor tanks can be readily converted into good fisheries. The sources of river pollution and the means to prevent it, and the construction of suitable fish passes in irrigation and hydro-electric weirs to ensure the free movements of migratory fishes are all problems of environment which need a careful study of the habits of fishes at the hands of zoologists before engineers can devise suitable measures for the conservation of fisheries. In all such studies, the role of the zoologists is to correlate the bionomics of any particular species of fish with the physical and biological factors in its environment. There is no doubt that in some cases collaboration and help of chemists and physicists is needed to understand properly the physical environment of a fish, but of late the bases of zoological teaching have been so broadened that several zoologists have qualified themselves for undertaking research in these lines also.

Systematics of Fishes.—The value of the systematics of fishes in the development of fisheries is generally underestimated, but a slight reflection will show that unless we can differentiate species, any real progress in ecology and bionomics of the food fishes is not possible. It is worthwhile to recall that in considering practical measures, which should be adopted for the development of fish industry in India, the *Ad hoc* Fish Committee of the Imperial Council of Agricultural Research in its meeting held in November 1937, expressed the opinion that—

> "In order to effect development upon satisfactory lines, it was necessary to carry out local surveys of the amount and class of fish available and in this connection proper identifications of the fish caught in each area was essential."

I can perhaps illustrate this point better by referring to the Hilsa fishery of India (*Journ. Roy. As. Soc. Bengal*, Science, VI, No. 2, pp. 93-112, 1941). We have found this species breeding under different conditions of salinity right from the deltaic region of the Ganges to as high up as Allahabad. We have also found that the Hilsa of East Bengal is somewhat different looking from the specimens taken from the river Hooghly at Calcutta. So the question naturally arises, are we dealing with one or more species under *Hilsa ilisha* (Hamilton)? On the analogy of Herring-fisheries in European waters and on the basis of our studies, European and American fishery experts have already surmised that there may be different races of Hilsa in our waters which breed under different environmental conditions. Hilsa, as we all know, is essentially a marine fish of the Herring family and, as at present understood, is known from the Persian Gulf, where it ascends into the Tigris river; from the coast of Sind, where it forms an important fishery in the Indus river and the Bay of Bengal whence it ascends into all the principal rivers of India and Burma. It is quite possible that different varieties and races of this species are found in Indian waters, but this point has not been investigated so far. Unless we thoroughly understand the systematics of this species, work on its ecology and bionomics for the proper management of its fishery may prove to be misleading.

It will thus be conceded that taxonomic studies form the bed-rock for all aspects of fishery research and development, and for these studies a sound knowledge of zoological science is most essential.

Breeding Habits and Life-Histories.—It is generally realised that for the development of the fishery resources of freshwaters, the establishment of hatcheries for the restocking of tanks, reservoirs, rivers, etc., and the framing of legislation to prevent interference with the spawning of freshwater fishes and the destruction of fry are some of the necessary measures which should be adopted. In recent years, these very measures have been advocated for the development of some of the marine fishery resources also. Even a very casual consideration of the above-mentioned problems will show the great need of zoological research, for without the knowledge of the breeding habits and life-histories of fishes, administrators are bound to commit several blunders in framing or administering fishery laws. I shall just cite one instance which will make this point clear. In the Inlé Lake, Southern Shan States, Burma, there are several species, about two dozen, which do not attain more than a couple of inches in length. There is an extensive and lucrative fishery of these small fish which yields a handsome revenue to the Government. Some administrator thought that these 'young' fish should be protected but the timely researches of the late Dr. N. Annandale (*Rec. Ind. Mus.*, XIV, P. 33, 1918) showed that these were adult fish and the fishery could continue without causing any deleterious effect to the productivity of the lake. "Close seasons to prevent annihilation of a species should always be based on research into the reproductive habits of the fish in question and disputes between owners of different types of gear can only be settled after attention to research on the swimming habits of the fishes taken by them" (P. E. P. Deraniyagala, *The Fisheries of Ceylon*, p. 8, Colombo, 1932).

The necessity and importance of the studies on the breeding habits and life-histories of all important food fishes for the development of fisheries is so obvious that I need not dwell any further on this point. Suffice it to say that these studies constitute purely zoological research which can be carried out best by specially trained fishery zoologists.

Biology of Fishes.—Under this heading we may consider all problems connected with food, growth-rate, enemies, parasites, migrations, and so on. The question of natural and artificial foods for fishes, especially in fish farms, is of

vital importance. We as zoologists know that all animal actions are determined by three main impulses, search for food, protection from enemy and propagation of the race. Several important fisheries depend upon the relative abundance and scarcity of food and the annual and periodic fluctuations in their yields are mainly influenced by the amount of food available in any particular year.

The biological problems enumerated above are more particularly concerned with freshwater fisheries where large number of fish are very often kept in a limited space, and where growth-rate, food, enemies and parasites can be controlled through the application of approved methods of fish farming. In the case of India the freshwater fisheries are of special significance from the standpoint of ameliorating the condition of the rural population.

"Human" Aspect of Fisheries

It has been shown above that in dealing with the 'biological' investigations connected with the development of fisheries, zoological studies and research have an important role to play. Even for the elucidation of the items listed by Annandale under "human", it will be noticed that a statistician with a zoological training will be able to collect more reliable fishery statistics than a person without any training to differentiate species or without any knowledge of the problems discussed above. For devising more suitable methods of capture, a knowledge of the swimming habits of fishes and the direction of migration will be of inestimable value. Similarly for devising fishery laws or regulations as to the sale of fish, a fair knowledge of the ecology and bionomics of fisheries is essential for suggesting effective measures.

It will thus be seen that for practically every aspect of fish production and conservation, zoological studies and research from the basis of an up-to-date fishery management. However, when we come to the utilisation of the product, zoologists need the help of technologists and marketing experts. Even here much better results can be expected from persons with a certain amount of zoological training and biological outlook.

Importance of Fisheries as a Source of Food

Having discussed the close relation that exists between the development of fisheries and zoological research and in view of the fact that the subject of the symposium is Zoology and the Food Problem, I wish to say a few words about the importance of fisheries as a source of food. As man must get his food either from land or aquatic sources, there are correspondingly two basic food industries, one comprising agriculture and animal husbandry, and the other, fisheries in a broad sense. The aquatic foods have one great advantage that they contain all the essential food elements, such as vitamins, minerals and proteins. It is necessary, therefore, that our fishery resources should be properly husbanded so that in times of emergency, like the present, they can be utilized very fully to supplement the deficiencies and failures of crops and food from the land. In their present undeveloped state, it is estimated that the value or primary production from fishing and hunting is only 120 millions of rupees and that the total catch of fish is 7,000,000 tons which, according to Dr. Radhakamal Mukerjee, yield ·7 billion calories as against the total requirement of the Indian population amounting to approximately 292 billion calories per annum, allowing 2,800 calories per man per day. These data indicate very clearly the great necessity of augmenting the present yield from our fisheries which are potentially very rich.

Importance of Fish in Indian Diet

As fish forms a specially valuable addition to a diet the staple of which is rice, it will be seen that its demand is greatest among the rice-eating population of India. For the same reason, in the countries of eastern and south-eastern Asia, and the adjacent great islands, the fisheries have always been of peculiar importance; since the mass of the people prefer fish to any other form of animal protein. In the north-western parts of India, where wheat forms the staple article of diet, dairy products and meat provide animal proteins in the dietary, while as we proceed eastwards along the Ganges or southwards to the peninsula, where rice forms the staple diet, dairy products become of less importance in the dietary, but fish, oil and root and leafy vegetables are in greater demand. In these parts of India even small fishes, which are good sources of protein, and sometimes of vitamin A, calcium and other inorganic elements, are consumed by non-vegetarian castes in fair quantities. From the dietetic surveys so far carried out in India, it seems that the conservation of fisheries and the greater use of fish as a principal article of diet are indispensable for the health of the nation.

Summary

Attention is directed to the necessity and importance of scientific research in the development of fisheries and it is indicated that nothing effective can really be done in India until there is a central organisation for fishery research. Reference is made to the nature of fishery investigations and it is shown how problems connected with the studies on the environment of fishes, systematics of fishes, breeding habits and life-histories, food, growth-rate, enemies, parasites, migrations and so on are dependent on zoological research for their proper elucidation. Even such items of fishery management as fishery statistics, fishery legislation, marketing, etc., can best be done by persons with zoological training and biological outlook. Thus in practically every aspect of fish production and conservation, zoological studies and research have an important role to play.

Reference is made to the importance of fisheries as a source of food and to the present-day estimated yield from Indian fisheries. The importance of fish in certain Indian diets is also indicated.

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TREATMENT OF BLACK WATER FEVER

Haemolytic substances were demonstrated in the peripheral blood of three patients. They appear a few minutes before an attack of hæmoglobinæmia, and are rapidly removed from the serum by the red blood cells; the hæmolytic properties of the serum can be preserved if the red blood cells are rapidly centrifugalised off (Singh and Singh, 1944).

The hæmolytic process is accentuated by quinine (1 in 300), pamaquine (1 in 1,000) and Mepacrine (1 in 500), and antagonised by antivenine (1 in 300); the latter also antagonises the action of drugs.

The clinical use of antivenene has been attended with complete success; 20 c.c. initially followed by 10 c.c. four-hourly completely cut short an attack of Black Water Fever in thirty-six cases, in which the mortality ordinarily would have been 25-50 per cent. Further in three cases, the administration of Mepacrine in full doses together with antivenine cured the Black Water Fever together with the causative malignant malaria.

Brigade Laboratory,
Allahabad, Inder Singh.
March 20, 1944. Inderjit Singh.

Singh, I., and Singh, I., *Ind. Med. Gaz.*, in the press.

RECOVERY OF AGAR FROM USED MEDIA

The used agar media from vaccine bottles, which is usually thrown away after killing the micro-organisms by autoclaving, was taken and heated in autoclaves to kill any organisms unattacked and coagulate the heat coagulable material. The whole was then filtered hot through two folds of muslin into aluminium 'Degchis'. It was found better to distribute it equally into three or four 'degchis' where it gave a jelly of smaller thickness, easier to wash. The product after gelatinisation was covered with excess of water overnight and in the morning supernatant water was poured off and the hard jelly broken into small pieces and washed with several changes of water. Washing was continued till no more colour came in water (about ten changes of water during four hours).

After this the washed stuff was transferred into a "degchi' and kept soaked in water. The water used for soaking was changed every four hours (about four times overnight) and in the morning the washed agar was put on a filter cloth and water allowed to drain off. Final drops of water were collected in a test-tube and tested for the presence of inhibitory substances with $FeCl_3$ reagent. The formation of turbidity or orange precipitate with a few drops of the reagent indicated the presence of growth-inhibiting substances and in that case the product required further washing. (For getting a negative $FeCl_3$ reaction, four or five quick washings with fresh lots of water were usually sufficient).

The washed agar at this stage was put in a filter cloth, fastened to a wooden frame and as much water allowed to drain off as possible. The product thus obtained was either first assayed for agar content by freezing a known weight of it in the Frigidaire and weighing the dry agar recovered therefrom, thus using the washed stuff straightaway for the preparation of nutrient agar media for vaccine bottles after the addition of required amounts of fresh agar and double strength broth to get a 4 per cent. concentration, or it was melted and filtered into suitable containers and cut into strips on setting and dried in the sun. Alternatively the

solution could be 'frozen' and agar 'isolated' in the usual way.

The recovered agar was found very suitable for bacteriological work on repeated tests. A 3 per cent. solution of this product was enough to give a film of good surface and consistency for the vaccine bottles. Normally a 4 per cent. concentration of commercial Japanese agar is required for this purpose.

The recovery was about 50 per cent.

D. G. Supply
Drugs and Dressings
Directorate, B. S. Roy.
New Delhi, J. N. Ray.
March 23, 1944.

A SIMPLE METHOD FOR THE MANUFACTURE OF AGAR-AGAR FROM *GRACILARIA LICHENOIDES*

The following gives a brief account of the simple process of preparation of Agar-Agar (B.P.) from sea-weed.

The dried sea-weed, *Gracilaria lichenoides*, a Rhodophyceæ, is washed free of sand and debris and soaked in a 1 per cent. HCl solution for 15 to 30 feet to remove encrusting and adhering calcium carbonate and washed in water until acid-free. After bleaching and drying in the sun, it is extracted in boiling water successively until the extract fails to jell on cooling. The extracts are combined, cooled to jell and the jelly so formed is cut up into small pieces, placed in a tall cylinder and roughly twice its weight of distilled water added, well mixed and left undisturbed for 48 hours, after which the excess water is strained through a muslin cloth. This process is repeated twice at 24-hour interval and finally the jelly is thoroughly washed and dried. The dried substance is Agar-agar.

The yield of Agar-agar is about 20 per cent. of the dry weight of *Gracilaria lichenoides*. Analytical data of Agar-agar prepared by this method, "Difco" brand Agar-agar, a standard product commonly used in biological laboratories as well as B.P. standards are given below for comparison:

Heads of analysis	Average of several samples	"Difco" Brand	B.P. Standards
	%	%	%
Moisture ..	16	17·48	Not more than 18
Nitrogen ..	0·17	0·22	..
Ash ..	3·60	3·0	Not more than 5
Insolubles ..	0·5	..	" 1
Setting power	1·0	1·5	" 1

P. D. Karunakar.
M. S. Raju.
S. Varadarajan.
Government Agricultural Chemist's Section, Agricultural Research Institute, Lawley Road P.O., Coimbatore,
March 13, 1944.

A NEW SYSTEM OF SOIL NOTATION FOR COMPARATIVE STUDY OF SOIL CHARACTERISTICS

The development of pedology as a science is of recent origin and several systems of soil classification have been put forward. Most of these have been evolved to survey large areas of land on basis of climate, genetic evolution, geological formation, soil colour, crops generally grown, etc., and have probably little practical value, as the variations within the groups so evolved are bound to be great. Soil survey of compact areas as opposed to general topographical surveys has, therefore, its own problems. If the survey is to be of any practical use, the number of samples to be analysed have to be very large and, therefore, the detailed chemical, mechanical and biological analyses have to be abandoned and a simple and effective method of evaluating the factor of primary importance has to be devised. In the revenue classification of soils in this country, the colour of the soil and incidentally soil texture are the only factors used for differentiating soils according to their relative yielding capacities. The texture of the first few inches of the soil and in some places, as in Bombay-Deccan, the depth of the soil over the basic rock are taken into consideration. The primary limitation of soil studies to the surface layers have, however, been rightly modified by recent workers who have shown that profile studies of soil horizons to a depth of three to five feet are very essential to soil classification. A concrete example of how the sub-soil can affect the quality of crops is afforded when the "mail" and "non-mail" rice tracts of Sind are compared. The mechanical analysis of the top layer is of the same order but in the "non-mail" tracts the sub-soils from one to two feet and two to three feet are decidedly sandy as compared to "mail" tracts thus accounting for the inferior quality of rice grown in these tracts. Further, it is now recognised that the field behaviour of a soil is more truly reflected by its aggregate analysis than by an ultimate analysis after mechanical dispersion involving the use of chemicals which act on the soil mass.

The present methods of expressing the different soil characteristics are far from satisfactory as they do not often lend themselves to easy adoption in practice. Thus the orthodox method of giving the values of mechanical analyses to two places of decimal is cumbersome while grouping soils as sand, loam, clay loam, sandy loam, etc., makes only a vague classification. A system of presenting the data of aggregate or mechanical analysis that may commend itself to field workers would be to round off the percentages of sand, silt and clay for each soil horizon to their nearest tens, and after eliminating the end zero, combine them to give a three figure number, which would denote the particular horizon. Thus at a glance it is possible to grasp the approximate textural composition of the soil and compare it with others without confusion. A number like 721 would, for instance, denote that the soil has 65 to 74·9 per cent. sand, 15 to 24·9 per cent silt and 5 to 14·9 per cent. clay. The

advantages of this representation are obvious.

This system of representation is elastic and any other data of importance could be associated with the index by appropriate number or alphabet. Thus the influence of climate can be incorporated with the soil index showing the textural composition. It has been shown in this laboratory that Meyer's factor, *viz.*, rainfall divided by absolute saturation deficit of the air, the latter being given by the formula:

100 – Relative humidity/100 × Mean vapour pressure (m.m.),

calculated from the meteorological data of research stations distributed all over India brings out the climatic variations and conforms with the climatic classification for soils into arid, semi-arid, humid, and per-humid zones. If this single value climatic factor is associated with the numerical index of soil texture the information conveyed by the index is greatly augmented. For associating the Meyer's factor it is modified by rounding to the nearest ten and eliminating the last zero so that brevity, so essential in such numeric representation, could be maintained.

In addition to the association of Meyer's factor with the index, the colour classification of the soils can also be associated likewise. Without attaching much importance to fine variations, the soil colours may be classified into the following groups, of which the initial letter or letters may usefully be associated with the numerical index: (1) Red (R), (2) Black (B), (3) Grey (G), (4) Brown (Br) and (5) Yellow (Y).

The following table gives the results of analysis of a few typical soils from various research stations together with an expression, in the last column, of these results by the above nomenclature. It may be seen that the comparative evaluation of soils is made simple by the adoption of the proposed system.

Locality	Aggregate analysis			Meyer's factor	Soil index
	Sand	Silt	Clay		
Black soils—					
Akola ..	39·6	40·4	20·0	141·4	B. 442·14
Labhandi ..	34·6	48·6	16·8	237·2	B. 352·24
Hagari ..	39·6	32·5	27·9	91·3	B. 433·09
Padegaon ..	35·2	38·4	26·4	132·3	B. 443 13
Red soils—					
Ranchi ..	60·2	31·7	8·1	318·1	R. 631·32
Taliparamba ..	52·1	31·3	16·6	753·9	R. 532·75
Coimbatore .	67·2	20·0	12·8	162·0	R. 721·16
Sirsi .	72·7	21·8	5·5	666·5	R. 721·67
Grey soils—					
Delhi .	72·9	19·6	7·5	123·7	G. 721·12
Kangra ..	59·5	34·8	5·7	676·0	G. 631·68
Shahjahanpur ..	81·6	15·6	2·8	205·3	G. 820·21
Karimgang ..	40·6	51·6	7·8	132·8	G. 451·13
Chinsuri ..	18·7	62·8	18·5	426·6	G. 202·43
Samalkot .	65·9	23·4	10·7	223·0	G. 721·22
Tabiji ..	90·2	7·4	2·4	110·2	G. 910·11

It is possible, on the same basis, to work out chemical indices for soils. Thus a soil containing 42 mgm. of N, 54 mgm. of P_2O_5 and 200 mgm. of K_2O could be represented by $N_4P_5K_{20}$ which would be a very suitable index for comparative purposes. Similarly, values for soil reaction and exchangeable bases can also be suitably abbreviated and added to this index wherever these values are known to influence crop yields.

The system of notation suggested here can be improved upon or modified to suit the individual problems of the soil surveyor. An agreed notation on these lines would greatly help in comparative soil studies and ultimately in all soil-crop relationships.

Imperial Agricultural Research Institute, New Delhi, *March* 20, 1944.

S. V. DESAI.
N. D. VYAS.
K. C. BATRA.

MANUFACTURE OF GLAND PRODUCTS

THE interesting article by Prof. B. B. Dey and his associates[1] has brought out much useful information which has a bearing on the utilisation of gland products under Indian conditions.

We have collected considerable amount of data bearing on the utilisation of pituitary and other glands, but owing to certain technical considerations, we are precluded from publishing all the related details.

PITUITARY GLAND

During the past fifteen months, we have processed pituitaries from about two lakhs of animals. We have further built up an organisation which is now dealing with a number of slaughteries and is handling about 20,000 glands per month.

We have concentrated chiefly on the beef glands, which are the only ones of practical value, particularly for the manufacture of post. pituitary powder. In our experience, the average weight of the glands varies from place to place in India, being dependent on the size of the animals which, in turn, is dependent on soil and climatic conditions. Thus, in a Western India centre, the average pituitary weighs over 2 grams, whereas at a South Indian centre, glands weighing less than 0·8 gram each are obtained. Irrespective of the location of the centre, one occasionally comes across a gland in which either the posterior or the anterior lobe preponderates.

In actual production, the average ratio of the separated posterior lobe to the residue (chiefly representing the anterior lobe) works out to about 1: 5. This is largely because some of the posterior lobe is left behind in the dissection. A certain amount of skill and speed is required in the manipulation because, after some time, the line of demarcation between the two lobes becomes rather blurred.

Experience has shown that a great deal of the earlier theory and practice in regard to the handling of the gland material, as also some of the concepts in regard to the stability of the hormone components, require revision. The active principles are comparatively stable, but there is apt to be much loss in handling. It is

particularly so when the gland materials have to be transported from one centre to another.

The final yield of the post. pituitary powder is determined by a number of factors including the skill of the operation. In some centres about 70 glands are required to yield one gram of the finished powder, while at others, even 25 to 30 glands are sufficient to yield the same result. The practical success would naturally depend on obtaining as favourable a ratio as possible.

We have carried out numerous assays on the products prepared by us. Practically every batch has been found to conform to the new International Standard. Our results have been independently confirmed by our colleagues at other centres. We can now state, with a certain amount of confidence, that, with necessary care and control, a product conforming absolutely to the new International Standard can be produced on a large scale in India.

THYROID GLAND

We have processed useful quantities of beef as well as sheep glands and have supplied the material for certain emergency requirements. The process offers no difficulty. The final product which was derived exclusively from one centre was found to contain about twice the amount of iodine (in combination as thyroxine) as that prescribed according to B.P. Standard. This may not, however, apply to other centres, so we refrain from generalising on this point.

The use of the thyroid in medicine is limited and the average medical practitioner seldom prescribes it. Fairly large quantities of the desiccated gland are, however, being prepared in different parts of the world (as also in India) and the major part of this material as also other whole gland materials go to make up certain rejuvenation remedies of a doubtful value.

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N. L. LAHIRY.
V. SUBRAHMANYAN.

Department of Biochemistry,
Indian Institute of Science,
Bangalore,
March 17, 1944.

1. *Curr. Sci.*, 1944, **13**, 35.

ADRENAL GLANDS

WE have been primarily interested in the production of *l*-adrenalin and have concentrated chiefly on beef glands as being of practical value. We have handled about 50,000 glands at one centre with a view to standardising the method of production.

We have occasionally found the absolute adrenalin content to be as much as 3 mgm. per gram of fresh tissues, but the average is about the same as that stated by Prof. Dey and his associates. Our earlier average yield was 1·8 gram per kg., but by improving the method of extraction, we have lately been able to raise it to 2 grams. The products prepared by us have been assayed by us and independently by a colleague at another centre and found to conform (within limits) to the standard.

There has been a certain amount of controversy regarding the relative merits of natural and synthetic adrenalin, with a strong section of medical opinion in favour of the former. From the economic point of view it is usually assumed that the natural product cannot hope to compete with the synthetic one, but this opinion is not justified. If the glands can be obtained at a reasonable price, adrenalin from the gland can be made at a lower cost than by synthetic method. Apart from the usually well-known precautions to ensure the stability of the hormone, effective extraction from the glands is an important factor determining the success.

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March 17, 1944.

UPPER JURASSIC MARINE ALGÆ FROM TRICHINOPOLY, S. INDIA

THE discovery of *Solenopora* in the Cullygoody limestone was reported by me on a previous occasion,[1] and two species, *S. jurassica* Nich. and *S. coromandelensis* S. R. N. Rao were figured and briefly described. A detailed account which has since been completed is now ready for publication. The marine flora recorded is a small one, but of exceptional interest: for the first time, it establishes a Jurassic horizon in the Trichinopoly area; and it has an important bearing on the age of the Upper Gondwanas of this region. The species present are listed below and the stratigraphical results arrived at briefly discussed.

The genus *Solenopora* has world-wide distribution and its range is from the Ordovician to Jurassic.[2] The Cullygoody algæ provide critical evidence for an Upper Jurassic age; they are very similar to marine floras from the Jurassic of other parts of the world.

The plants as a whole are definitely archaic; the algal vegetation of the world took a modern aspect in the Lower Cretaceous when true Corallinaceæ (with *Archæolithothamnium* as the earliest representative) first appeared—shortly after *Solenopora* and other ancient genera had become extinct.

Besides the algæ, thin sections of the limestone occasionally show indeterminate fragments of a land plant and some arenaceous foraminifera. The latter consist mostly of *Choffatella* whose age is Lower Jurassic to Lower Cretaceous.

It is interesting to note that a Jurassic alga (*parachætetes*) has already been recorded by Dr. Pia from the Danian Niniyur beds of the Trichinopoly area.[3] This genus is not known to have survived the Upper Jurassic in other parts of the world. I have some reasons to believe that it is a derived fossil in a Danian matrix; palæontological anachronisms of this kind are frequent in the Trichinopoly area.

The Cullygoody limestone[4] is correlated with the Coral reef limestone (the basal member of

Cullygoody Algæ: Geographical and Stratigraphical Distribution

	Perm.	Trias.	Lias.	Oolite.	L. Cret.	Up. Cret	Eocene
S. coromandelensis S. R. N. Rao ..							
S. jurassica Nich.				E, Fr.			
Marinella jurassica Pfender ..	Nm.		Sp, Sy.	M, J.	A.		
Symploca jurassica Francey & Dangeard			Sp.	Fr, C, Mg.			
Pseudolithothamnium alba Pfender ..					C, Sy, Sp.	Fr.	An, B, Mg

A=Angola. C=Carpathians. J=Japan. Nm=New Mexico.
An=Anatolia. E=England. M=Moravia. Sp=Spain.
B=Baluchistan. Fr.=France. Mg=Madagascar. Sy=Syria.

the Utatur series) and considered to be Albian in age. In view of the discovery of *Solenopora* in this limestone, its relationship with the Utatur series needs further examination. The Coral reef limestone, it may be noted, rests directly on the Archæans and in some places Upper Gondwana plant beds intervene between the two.

Department of Geology,
Intermediate College,
Bangalore, S. R. NARAYANA RAO.
February 2, 1944.

1. Rao, S. R. N., *Palæobotany in India, Prog. Rep.*, Lucknow, 1942, **4**, 178. 2. *Solenopora urgoniana* Pfender described from the Lower Cretaceous of France differs markedly from the Jurassic *Solenopora* as admitted by the author (*Bull. Soc. Geol. Fr.*, 1930, **30**, 104) and it is probably a *Petrophyton*. *Solenopora rothpletzi* Yabe (*Metasolenopora rothpletzi* Yabe) stated to be Lower Cretaceous by Dr. Pia (Handbuch der Palæobotanik, 1927) is really Upper Jurassic (see Yabe and Toyama, *Sci. Rep. Tohoku Imp. Univ.*, 1928, **1**, 3). 3. Rama Rao and Pia, *Pal. Ind. n. s.*, 1936, **21**, No. 4. 4. Blanford, H. F., *Mem. Geol. Surv. Ind.*, 1862, **4**; Rama Rao, 'The Cretaceous rocks of Sonth India', *Lucknow Unit. Studies*, 1942, **17**.

ON THE PRODUCTION OF TRUE PILEI OF *POLYPORUS BRUMALIS* (PERS.) FR. IN ARTIFICIAL CULTURE

THE exact conditions under which a fungus will produce sporophores on artificial media is still an open question. Buller[2] has tackled the problem mainly with the Agarics. Many other workers during recent years have tried to throw light on the subject but no definite conclusions have yet been arrived at.

Polyporus brumalis was growing saprophytically on a dead log in Calcutta, in July, 1942. A fresh fruit-body was collected and spore-deposits were taken on sterile agar plates from which several polysporus cultures were made in culture tubes (6"×½") on Potato-dextrose agar, Oat-meal agar, Malt-extract agar, and Brown's Potato-starch agar. These cultures were then kept in an inclined position and subjected to different conditions of temperature, namely, constant temperatures of 22° C. and 33° C. and a variable temperature of 23°-27° C. of the laboratory. Under these conditions, again, the cultures were kept in complete darkness as well as in diffused light. In all cases, however, germination of spores started within 24 hours.

All young cultures at first developed a felty mat which later on became appressed and subfelty. Stalks of fruit-bodies appeared in several cultures under the aforesaid different conditions. The first culture to fructify was on Oat-meal-agar kept in diffused light and at 33° C. (Fig. 1) in about a month. In this particular case, three rudimentary stalks appeared at the base of the tube when the original position of the tube was altered and made vertical. Subsequently, it was observed that the growth of two stalks was checked while the third one continued its upward development. In no case, however, pileus was formed. Later on, similar stalks developed in tubes kept in other conditions including those placed in complete darkness. The treatments suggested by Long and Harsch[3] were made for *Polyporus brumalis* but without any success. By allowing the light to fall on the top and none from the sides, the stalks of the fruit-bodies elongated in the direction of light proving that they are positively phototropic. The upward growth of the stalks is purely incidental and has no relation to gravity. This was shown in culture-tubes which were kept in a horizontal position and the vertical stalks arising at the base of the tubes soon turned their apices and grew horizontally parallel to the glass surface. To see whether lowered humidity in the culture-tubes due to age was preventing pileus-formation, a few drops of sterile distilled water were introduced aseptically into the culture-tubes from time to time but with no desired result.

It appeared to the authors that aeration might possibly be the factor preventing pileus-formation in this case, since in such closed culture tubes, the space was limited and consequently the aeration affected. Several cultures were then made on the new medium advocated by Badcock[1] in Erlenmeyer flasks of 1,000 c.c. capacity each. A good growth was obtained in all of them. A stalk of the fruit-body developed in about a month which elongated and branched repeatedly. The surfaces of such stalks were not smooth but had numerous

foldings. The tip of the stalk reached the base of the plug and there remained as such without forming any pileus. But as soon as the plug was opened, the stalk elongated, reached the neck of the flask and then formed a normal pileus (Figs. 2 and 3).

FIG. 1

FIG. 2

FIG. 1. Stalks of fruit-bodies arising from the base of the tube.

FIG. 2. Formation of a normal pileus at the mouth of the flask when the plug is opened.

FIG. 3

FIG. 3. A magnified view of the pileus showing pore-mouths.

Thus, the conditions under which normal fruit-bodies of *Polyporus brumalis* developed in artificial culture could be determined from the above experiments. That light has no direct effect on sporophore-production is universally true and this had also been proved for the fungus under discussion. Temperature seems to have little control over the formation of fruit-bodies for sporophores developed in cultures irrespective of different temperatures. The relation of humidity to sporophore-production in culture-tubes is also not conclusive, for, the addition of sterile distilled water to cultures had no effect upon them. It might seem, at first, that the accelerator in Badcock's medium was responsible for pileus-formation. A mycelium never forms fruit-bodies until its hyphæ have accumulated from the substratum sufficient food material to ensure that any reproductive effort shall not fail through lack of food material. Badcock's medium offered a rich growth for the fungus in that sense but the factor retarding the formation of pileus was aeration. This was proved on observing that the pileus formed only when the plug was opened, when this stipe grew in length, reached the neck of the flask and receiving oxygen supply formed the normal pileus. In such closed culture-tubes where the mycelium is vigorously respiring, the atmosphere within, naturally becomes toxic due to accumulation of CO_2 and it is probable that if oxygen be supplied to these cultures from time to time, this toxic effect will be neutralised and fruit-bodies will be formed. Observations supporting this are now being made with other fungi and special devices are made for supplying oxygen. The results of these investigations will be communicated elsewhere later on.

Our sincere thanks are due to Prof. S. P. Agharkar, Head of the Department, for the facilities given.

SACHINDRA NATH BANERJEE.
BIMAL KUMAR BAKSHI.
Department of Botany,
Calcutta University,
December 13, 1943.

1. Badcock, E. C., "New methods for the cultivation of wood rotting fungi," *Trans. Brit. Myc. Soc.*, 1941, **25**, 2. 2. Buller, A. H. R., *Researches on Fungi*, Vols. 2 and 4. 3. Long, W. H., and Harsch, R. M., "Pure cultures of wood-rotting fungi on artificial media," *Jour. Agri. Res.*, 1918, **12**, 2.

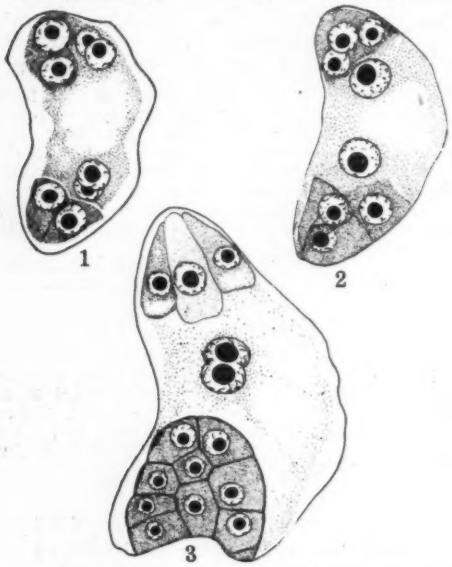
A REINVESTIGATION OF THE EMBRYO-SAC OF *ERAGROSTIS CILIANENSIS* (ALL.) LINK.

STOVER (1937) first investigated the development of the embryo-sac of *Eragrostis cilianensis* (All.) Link., and reported an extremely interesting organisation of the micropylar group of four nuclei of the eight-nucleate embryo-sac, which is developed in the normal manner. According to him, one egg, one synergid and two polar nuclei are organised by the micropylar group of four nuclei. Regarding this work Maheshwari (1941) wrote: "Unfortunately the figures are not convincing and a reinvestigation of the plant is necessary before his interpretations can be accepted." For reinvestigation authentic seeds of the species were obtained by the kind courtesy of Prof. L. S. S. Kumar, Agricultural College, Poona. The plants were grown locally and the material was collected from these.

The development of the nucellus, integuments and ovule proceed in the same manner

as has been described by Stover (1937). As he has already recorded, the primary archesporial cell does not cut off any parietal cell, a T-shaped tetrad of megaspores results after the reductional divisions; the lowermost megaspore develops further. Upto the third division of the megaspore nucleus Stover's observations are in agreement with those of the writer.

Soon after the formation of four nuclei at each pole of the embryo-sac, one can see the characteristic large vacuole separating the two groups of nuclei. First, the plasma around the two nuclei lying nearest to the chalaza becomes dense and soon gets separated as two antipodal cells. When this is complete, a similar phenomenon is seen in relation to two of the nuclei at the micropylar end also. Fig. 1 represents the embryo-sac at about this stage. At



FIGS. 1, 2 and 3. × 480. For explanation see text.

a slightly advanced stage, only one of the other two free nuclei of the chalazal group becomes embedded in dense plasma, and the other nucleus remains free and slightly increases in size. This process repeats more or less simultaneously at the micropylar end also and the nucleus thus separated becomes conspicuous by its slightly enlarged size (Fig. 2). These two free nuclei, one at each pole of the embryo-sac, constitute the respective polar nucleus. They move towards each other until they unite and fuse (Fig. 3). The fusion is completed before fertilization and the fused diploid nucleus lies nearer to the egg apparatus. The remaining three nuclei at the micropylar end becomes organised into two typical synergids and one egg. The egg is slightly larger and possesses a similar nucleus.

The nuclei of the three antipodal cells, soon after their formation, undergo prophasic changes for further divisions. Stover observed that only one or two of the antipodal cells divided further resulting in five or six cells. The present investigation, however, clearly shows that all the three antipodal cells take part in increasing the number of antipodal cells. Most of the mature embryo-sacs showed as many as twelve cells forming a compact mass (in Fig. 3 only nine such cells are shown, as the other three cells were in the next serial section of the slide). This mass of antipodal tissue degenerates after fertilization.

It will be evident from the preceding account that the development of the embryo-sac in *Eragrostis cilianensis* (All.) Link., is quite typical, except for an increase in the number of the antipodal cells which is a dominant tendency among the members of the family. Hence, Stover's claim, that the organisation of the embryo-sac in this plant "is a new type not only for the grasses but for all plants", becomes invalid.

Basavangudi,
Bangalore,
March 14, 1944. B. G. L. SWAMY.

Maheshwari, P., *Jour. Ind. Bot. Soc.*, 1941, **20**, 229–61. Stover, E. L., *Chio. Jour. Sci.*, 1937, **37**, 172–84.

A NEW AMPHIBIAN TRICHOSTRONGYLID

TRICHOSTRONGYLIDS which form an important group of Nematodes are of rare occurrence in the Amphibia. The well-known genus *Oswaldocruzia* has been described from several parts

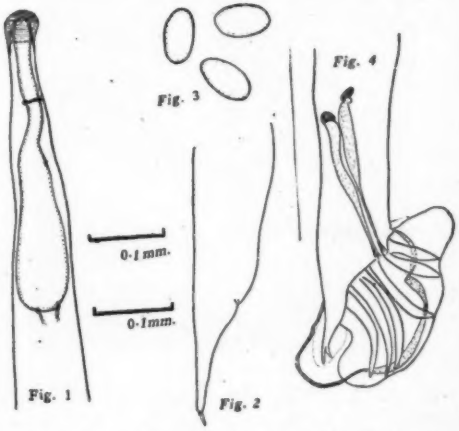


FIG. 1. *Oswaldocruzia indica* n. sp. Female, anterior end.

FIG. 2. *Oswaldocruzia indica* n. sp. Female, posterior etd.

FIG. 3. Eggs of *Oswaldocruzia indica*.

FIG. 4. *Oswaldocruzia indica* n. sp. Male, posterior end showing spicules and bursal rays.

of the world from amphibian hosts but in India its occurrence was not reported till 1942[1]

when the writer obtained a few specimens of *Oswaldocruzia* from the intestine of the common toad, *Bufo melanostictus* at Lucknow. Further search for these parasites was continued and the genus *Oswaldocruzia* is now being reported from *Rana cyanophlyctis* as well, although the frequency and percentage of infection in both *Bufo* and *Rana* are extremely low.

The worms are very thin and white or whitish-grey in colour, and do not show great mortality in life. The head has a distinct cuticular inflation which shows transverse striations. The lateral membranous wings are absent. The cervical papillæ are present. The following table gives the measurements (in millimeters) of the male and female specimens:—

	Male	Female
Length ..	4·9	10·9
Width maximum ..	0·1	0·23
Head inflation length ..	0·03	0·05
Œsophagus length ..	0·3	0·42
Head nervering distance	0·12	0·135
Anus tail (including spike) distance ..		0·18
Vulva tail distance ..		3·8
Spicule length { ..	0·22	
{ ..	0·20	
Eggs	0·075 — 0·08 × 0·04 — 0·05	

Host: *Bufo melanostictus; Rana cyanophlyctis.*
Locality: Lucknow, U.P., India.

DISCUSSION

The genus *Oswaldocruzia* was erected by Travassos (1917)[2] and since then quite a large number of species have been added to the genus. Recently Walton (1938)[3] gave a summary of various amphibian species of this genus. Later Freitas and Lent (1938)[4] described one species from Rio de Jenero, Brazil; and Koo (1939)[5] added another species from Canton, China. The genus was split up into two sub-genera *Oswaldocruzia* and *Bialata* by Morishita (1926)[6] on the basis of the presence or absence of lateral membranous wings although this distinction has not been rigidly followed by later workers. The important amphibian species[7] of the sub-genus *Oswaldocruzia* are as follows:—

1. *Oswaldocruzia* (*Oswaldocruzia*) *filiformis.*
2. „ „ hoepplii.
3. „ „ leidyi.
4. „ „ mazzai.
5. „ „ *waltoni.*
6. „ „ lopesi.
7. „ „ *heparia.*
8. „ „ subauricularis (Type species).

The present form does not bear lateral expansions of the body and hence may be put under the sub-genus *Oswaldocruzia* (*Oswaldocruzia*) according to Morishita. It differs from the species *heparia, hoepplii, mazzai, waltoni, leidyi* and *lopesi* in having much larger spicules in the male in proportion to the size of the body and also in the size of the eggs and the œsophagus. The present form comes nearest to the species *filiformis* and *subauricularis* but from both these it differs in the shape of the spicule and the dorsal ray and in having smaller eggs. It is, therefore, regarded as a new species to which the name *Oswaldocruzia* (*Oswaldocruzia*) *indica* is given.

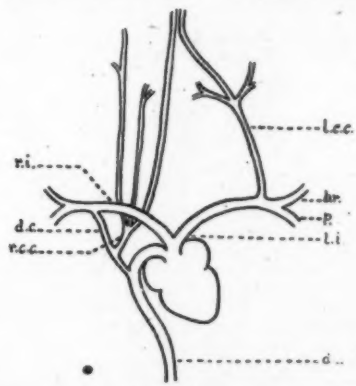
Lucknow University, M. B. LAL.
February 2, 1944.

1 Lal, M. B., *Curr. Sci.*, 1942, **2**, No. 8. (One species from Nicobar islands was described by Baylis and Daubney, *Rec. Ind. Mus.* Calcutta, 1923, **25**). 2. Travassos, *Braz. Medic.*, 1917, **31**. 3. Walton, *Trans. Amer. Micros. Soc.*, 1938, 57–(1). 4. Freitas and Lent, *Mem. Inst. Oswal. Cr.*, 1938, Tom. **33**, Fas. 4. 5 Koo, *Ling. Sci., Jour.*, 1939, **18**, No. 2. 6. Morishita, *Jour. Fac. Sci. Imperial Uni. Tokio*, 1926, **1**, part I, 7. Travassos, *Mon. Inst. Oswal. Cr.*, 1937, 1–vii.

PERSISTANCE OF DUCTUS CAROTICUS AND THE UNUSUAL ORIGIN OF THE RIGHT COMMON CAROTED IN THE PIGEON

AN unusual abnormality was noticed by me in a dissection of the pigeon which is worth recording for its rarity. Previous records of abnormalities in the arterial system of birds including pigeon relate to the persistence on the right side, of a vessel, the ductus caroticus connecting the common carotid artery with the systemic or aortic arch. These are all obviously cases of a persistent embryonic condition in the adult.

In the specimen of pigeon dissected by me, while the ductus caroticus persisted as in the previous cases recorded, the common carotid of the right side, instead of arising as in those



Ventral view of the arterial arches of pigeon
br.—brachial artery; *d.a.*—dorsal aorta; *d.c.*—ductus caroticus; *l.c.c.*—left common carotid artery; *l.i.*—left inromirate; *p.*—pectoral artery; *r.c.c.*—right common carotid artery; *r.i.*—right inromirate.

cases from the innominate (Brachiocephalic), was given off from the ductus. From the ductus

arose a common trunk which soon divided into three branches corresponding to the three branches on the left side of one of which is the common carotid.

The points of interest in this specimen are:—

1. The ductus caroticus did not connect the carotid and the systemic; on the other hand, the carotid arose from it.

2. The innominate of the right side consequently represents only the subclavian of that side and the ductus connects the subclavian with the aortic arch.

3. The unusual and embryologically unexplainable origin of the right common carotid from the ductus.

4. The right common carotid arising from the ductus gives off its two branches at a much lower level than does the left carotid.

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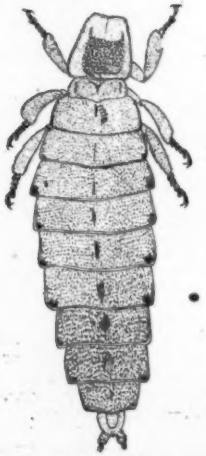
February 1944.

AN ADULT FEMALE LAMPYRID FROM PAMPADAMPARA, S. INDIA

This paper is based on three specimens collected and sent to me from Pampadampara, N. Travancore, in February 1942, by Mr. C. J. Selvaraj. These forms appear to be rare and as I am not aware of any previous description it is extremely difficult to identify. Most probably this is an undescribed female of an already known male. As Mr. J. C. M. Gardner writes to me, very little is known of Indian Lampyrids and it appears impossible to determine females and almost impossible to determine males with certainty. Very little work has been done on the systematics of Indian Lampyridæ and the family requires a thorough revision.

Length: About 40 mm.
Colour: Creamy white.



Female Lampyrid from Pampadampara

Head is retracted into the prothorax. Head capsule is broader than long and bears dorsally two brownish longitudinal striæ and laterally two large black compound eyes. The antennæ spring apically from the narrow preocular region of the head. Dorsally the posterior margin of the head-capsule carries a median rounded lobe. Ventrally the head-capsule is bridged by a broad thin gular plate, which occupies the posterior half only. The hypostomal ridges are parallel and bear anteriorly the acetabula for the articulation of the mandibular postartis. Labrum is a median lobe devoid of any distinct sutural demarcation from the rest of the head-capsule. It is slightly notched at the free margin and carries a fine marginal brush of hairs. The antennæ are 11-jointed[1] and finely setose with the basal joint largest and basally constricted; second shorter than third which is longer than any of the remaining joints except the basal. Mandible is considerably reduced to a flat lobe carrying externally a row of long hairs and internally a dark cutting edge with a brush of very short hairs. The apex is rounded and provided with a minute mucronate spine. The gular plate is basally broader, laterally inflexed and each anterolateral apex is produced into a long process directed vertically upwards into the head. Anteriorly the gular plate gives articulation to the cardines and the post-labial sclerite. Cardo is small. Stipes bears anterolaterally a Palpifer which carries the 4-jointed maxillary palp, basal joint of which is small, second and third distally wide, while the apical is large and compressed along the inner anterolateral margin which is provided with a dark spot. The galea is dorsal, white, cylindrical and setose. The labium is narrow and strengthened posteriorly by a post-labial sclerite whose posterior half is more sclerotised than the setose anterior half. Palpigers are present and they bear the 3-jointed labial palps. Ligula is represented by two whitish cylindrical structures.

Thorax.—Pronotum is slightly broader than long and sinuate anteromedially with the anterolateral margins rounded, posterior margin wavy, median carina feebly emphasised and disc convex and diaphanous anteriorly. Mesonotum is conspicuously smaller and anteriorly differentiated into a prescutal area by a strong suture. Metanotum is considerably broader than the mesonotum and the median carina very feeble. The plates are clothed uniformly with short fine hairs and sometimes irregularly wrinkled. The legs are devoid of spines so characteristic of the lampyrid larvæ but densely clothed with fine hairs. Coxa is large, coxo-trochantral articulation dicondylic and movable, trochantero-femoral joint immovable, trochanter undivided, femur long and more or less dilated, tibia almost as long as femur with its outer edge foliaceously dilated and longitudinally grooved, tarsus pentamerous, subapical joint being bilobed and apical bearing a pair of claws.

Abdomen.—Eight terga and eight sterna are visible. Sixth and seventh sternal plates are 'eburated' and together constitute the photogenic organ. Segments 9 and 10 are modified

into a soft genital tube telescoped into the preceding segments. Posteriorly a pair of minute anal appendages occur, each with a stout cushion-like basal joint and a small chitinised setose apical joint. The tergal plates are devoid of the median longitudinal channel or sulcus and their margins strongly ribbed. The second abdominal plate (DP_2) is the broadest plate. The sternal plates are rectangular and devoid of spines. The eighth sternal plate is small and not rectangular. The spiracular sclerites are continuous with the sterna, but separated by strong wrinkles. The whole interior of the trunk is loaded with the massive ovary. Although the ovary appears as a single extensive mass, the oviducts are paired and distinct as in the adult female *Lamprophorus tenebrosus* Wlk.

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Madras,
March 6, 1944.

1. In one of the specimens examined the apical joint was distinctly sub-divided dorsally so as to make up the antenna 12-jointed, but not so ventrally.

ON THE OCCURRENCE OF DIAPAUSE IN THE EGGS OF INDIAN CYPRINODONTS

RECENTLY, while going through the article of George S. Myers[1] on "Studies on South American Fresh-water Fishes", I came across the following interesting remarks on the Cyprinodone fishes of the genus *Cynolebias**:—

"The fishes of this genus are now known, through the works of aquarists and aquarium collectors, to be annual fishes which complete a full life-cycle within one year. They are rare or absent in ordinary streams and permanent lakes and ponds, being common only in isolated water-holes, swamps and puddles that dry up in the dry season. The fishes require a deep mud bottom. The eggs which are very tough-shelled and resistant, are deposited in the mud when the ponds have begun to dry up. The adult population is wiped out upon the complete drying of the ponds and the species exist over the dry season only in the egg stage, buried in the damp mud under the hardened top crust. Advent of the wet season, with accumulation of water in the ponds and the softening of the mud initiates the hatching of the eggs. Development of the fry is exceedingly rapid, for in some instances full growth is attained in two or three months. .... Certain African species, *Aphyosemion cæruleum* for one, as well as several species of *Nothobranchius*, also are short-lived, and produce tough eggs which, in the few instances in which the fishes have been bred have been found to take one to several months to hatch. It is probable that these species, especially *Nothobranchius* from the drier plains of East Africa, are annual fishes."

Some time ago, while making observations[2] on the breeding and development of *Oryzias melastigma* (= *Aplocheilus melastigma*), I found that especially during the hot seasons if the water in the aquarium was not replenished the hatching time of the eggs was unduly prolonged. This phenomenon was rather puzzling since under similar conditions the eggs of other fishes did not show any remarkable difference in the incubation period. It was seen in a number of instances that some of the eggs of *O. melastigma* kept in a vessel would hatch out within the normal period of 8 to 14 days whereas the rest would remain with healthy embryos for weeks together except a few that died. Instances of diapause up to six weeks have been observed by me. No records were taken of the incidence of this phenomenon during the different parts of the year and observations were not conducted under natural conditions. The delay in hatching has never been consequent on the slowness of development as both in the early and late hatchers the rate of development of the embryo has been the same and it was the fully developed 'ready to hatch' larva that was in a state of diapause. Perhaps the only difference between the fry of the two sets was that in the early hatchers the larva possessed a little yolk, less of pigmentation and fewer fin-rays. Another interesting fact observed in the case of the eggs of this species is that if fresh-water or water of much lower salinity is added the eggs would hatch and quite normal and healthy larvæ would immediately come out. Sometimes such eggs were removed one by one into a petri-dish and just to watch the fry coming out, a jet of water was directed on to them from a pipette with the desired result. The reason for this could be explained to the sudden change in osmotic pressure due to the addition of fresh-water making the egg membrane burst since in all instances the water in which the eggs were kept was from the brackish water areas of the Cooum and Adyar, Madras. In natural conditions also the principle involved in the hatching of the eggs should be similar.

Though it appeared to me even then that this state of diapause during the egg period may be a sort of natural provision to tide over unfavourable conditions and ensure a copious supply of fry by the onset of the rains, when conditions become ideal for growth and migration, it was dismissed as rather a premature conclusion and only remarked that in some cases the hatching period has been found unduly prolonged.[2] It is clear now that this view is correct and though Indian species might not have developed such a degree of

* Since sending this note for publication I was able to go through "*Tropical Fishes for the Home: Their Care and Propagation*" by F. H. Stoye (New York, 1935) in which interesting accounts on the breeding of the fishes of the genera *Aphyosemion*, *Nothobranchius* and *Cynolebias* are given.

specialization as the American and African species, this may be an incipient tendency towards that condition. The capacity of the eggs of Cyprinodonts to lie dormant during unfavourable season in stagnating water would certainly enhance their suitability as larvicidal fishes.

Regarding *O. melastigma*, Job[3] says that "At Calcutta they hatched out in eleven days in water at 88° and in fourteen days in 85°. A few eggs kept in a vessel without change of water hatched out in nineteen days". In the case of other Cyprinodonts some variations in the incubation period are recorded by Job[3] in *Aplocheilus panchax* and by Kulkarni[4] in *Horaichthys setnai*.

The views of some of the former workers on this subject are as follows. Tennent[5] in his *Natural History of Ceylon* refers to the belief that eggs of many tropical fishes are able to tide over the dry season in the mud and gives reasons against such a possibility. He is of opinion that the mature fish bury themselves in the mud under the hardened top crust and come out ready to spawn at the advent of rains. Thomas[6] emphasizes the need for more work for studying the capacity, if any, of the eggs of tropical fishes to æstivate. Day,[7] in the absence of any definite data, declines to make any comment on the view that fish full of spawn are able to æstivate till the commencement of the next rains.

I am indebted to Dr. George S. Myers of the Stanford University for sending me a copy of the *Stanford Ichthyological Bulletin* containing the article referred to above, and to Dr. S. L. Hora, Director of Fisheries, Bengal, for going through this note and communicating it for publication.

Central Research Institute,
University of Travancore,
Trivandrum, S. JONES.
December 11, 1943.

1. Myers, George S., *Stan. Ichth. Bull.*, II, 1942, 4. 2. Jones, S., *Proc. Ind. Acad. Sci. (B)*, 1937, **56**. 3. Job, T. J., *Rec. Ind. Mus.*, 1940, **42**, 1. 4. Kulkarni, C. V., *Ibid.*, 1940, **42**, 2. 5. Tennent, J. E., *The Natural History of Ceylon*, 1861. 6. Thomas H. S., *Report on Pisciculture in South Kanara*, 1870. 7. Day, F., *Report on the Fresh-water Fish and Fisheries of India and Burma*, 1873.

ON THE BIONOMICS OF THE BIG-JAWED JUMPER, *LACTARIUS LACTARIUS* (Cuv. & Val.)*

THE Big-jawed Jumper, *Lactarius lactarius* (Cuv. and Val.) is a shoaling fish contributing to an important fishery in the Gulf of Manaar and Palk Bay, from the month of June to the month of January. The peak of the fishery occurs in September and October.

Food.—The Big-jawed Jumper is a piscivorous fish, feeding on other smaller species such as the Sprat (*Sardinella gibbosa*), the Anchovy (*Engraulis indicus*), the White-bait (*Stolephorus sp.*), the Jew-fish (*Sciæna glauca*), the Silver-bellies (*Leiognathus sp.*), young Ribbonfish (*Trichiurus savala*), the Sole (*Pseudorhombus arsius*), the Shrimp (*Acetes japonicus*) and the Prawn (*Peneus sp.*). Of these, the White-bait appears to be its favourite food.

Size.—Over three thousand specimens, ranging in size from 11 to 25 cm., were examined in the laboratory of Krusadai Biological Station during the years 1940-41, 1941-42 and 1942-43. The commercial catches consist mainly of specimens 17 to 21 cm. in length. The percentage of males in a shoal is always lower than that of the females, in some cases it being as low as 25. The males are smaller measuring within 18 cm.; and they become mature when they are 16 cm. in length, whereas the females are larger, attaining a length of 25 cm. and they become mature when they are 18 cm. in length.

Spawning season.—The spawning season is confined to the months of September and October, when the fishery is at its height. Mature females form the bulk of the commercial catches; yet their heavy destruction does not seem to diminish or deplete the fishery.

Eggs.—The ripe ovarian egg measures 0·56 to 0·76 mm. in diameter, with a single large yellowish oil-globule measuring 0·2 mm. in diameter. Attempts made to collect the free eggs from the sea off Thangachimadam (a fishing village four miles east of Pamban) where the fishery takes place, have not met with success. It is probable that the ripe fish go to the open sea beyond the three-mile range of the catamarans, to spawn there unmolested.

Fisheries Bureau,
Madras, P. I. CHACKO.
February 24, 1944.

* Published with the permission of the Director of Industries and Commerce, Madras.

SIR JEREMY RAISMAN'S BUDGET SPEECH

WE wish to invite the attention of our readers to the relevant portions of the enlightened budget speech of Sir Jeremy Raisman, the Finance Member to the Government of India (appearing elsewhere in this issue), relating to the capital and recurring grants for the establishment of National Research Laboratories. This generous gesture, which is "a practical expression of the Government's resolve to foster the development of Indian industry", it is hoped, will soon be followed by more substantial grants.

REVIEWS

Optical Workshop Principles. By Col. Dévé Translated by T. L. Tippell. (Adam Hilger Ltd.), 1943. Pp. 306 + xiv. 20*s*.

Le Travail Des Verres D' Optique De Precision by Col. Dévé was originally published in Paris in 1936. The book under review is an English translation brought out last year by Adam Hilger Ltd. It is in two parts, the first dealing with the elementary aspects and the second dealing with the more difficult and precise operations of optical technology. Under the elementary aspects, the properties of glasses, their faults and the principles that should guide one in choosing raw material are dealt with. There is a very useful account of different kinds of abrasives and cements. Hints which are of great practical value are given as to their utility under different conditions. In the same part, methods of surfacing are also dealt with. In the second part, definitely intended for those interested in work of high precision, the subject of surfacing is dealt with in greater detail and the use of test plates of different types is described. The processes of cutting, grinding and polishing varieties of crystals are described. Various other processes such as centring, edging, cementing, etching, silvering, etc., a knowledge of which is essential for a person working in Applied Optics are also dealt with.

The book contains a large amount of interesting and valuable information. It is eminently practical in its outlook and is accordingly indispensable to people engaged in optical work. The technique of producing either flat or curved surface to a state of perfection demanded by modern requirements is a highly specialised one and there are very few books in the English language which deal with this aspect of optics. The present publication is very welcome from this point of view.

S. B.

Experiment and Theory in Physics. By Max Born. (Cambridge University Press), 1943. Pp. 44. 2*sh*.

This pamphlet contains the substance of an address given by the author to the Durham Philosophical Society and the Pure Science Society in King's College at Newcastle-upon-Tyne. Basing himself on the details of some outstanding events in the development of modern physics, the author discusses the methods employed by the two extreme schools of investigators comprising on the one hand of men who declare experiment to be the only genuine method of science and on the other of men who claim that all universal laws of nature could be derived from pure epistemological principles and without any appeal to experiment. According to the author the history of modern physics shows that theoretical conceptions and experimental discoveries were alternatively taking the front place as time went on and we owe the present position neither to pure reason alone nor to pure experiment alone but to a process of mutual interaction giving rise to a long chain of empirical research and synthesis. The author concludes by stating that scientific prophecy is better based on the facts of experience than on abstract reasoning. The pamphlet forms an interesting reading.

S. B.

An Introduction to the Modern Theory of Valency. By Dr. J. C. Speakman. Second Edition. (Edward Arnold and Co., London), 1943. Pp. 159. Price 5*sh*. 6*d*.

This book amply justifies its claim to be an introduction to the modern theory of valency. It is written in an easy flowing and convincing style, and takes the reader right from the basic principles of electrovalency and covalency described in the first five chapters, to a lucid and non-mathematical survey of the essential features of modern valency theory based on the methods of quantum and wave mechanics. Chapter VI deals briefly with the mechanism of covalency bond formation through coupling by the exchange resonance of valency electrons belonging to different nuclei. This concept of electrons in resonance, leads to the possibility of different electronic arrangements for the same molecule being coupled to each other by exchange resonance, forming thereby a "resonance hybrid" of greater stability. Chapter VII describes some of the important quantitative studies on valency bonds. In the reviewer's opinion, an adequate reference to the vibration frequencies for these bonds as evaluated by the very elegant method of Raman spectra would make the picture more complete. Chapter VIII describes very clearly the concept of intermolecular linking by hydrogen bonding, and also makes an adequate reference to other types of intermolecular coupling through unidipole, dipole-dipole, and Van der Waals or "dispersion forces". The succeeding chapters deal with polar and non-polar compounds, relationship between electrovalency and covalency, and the varying valencies exhibited by the elements in the long periods. Chapter XII on Co-ordination and Hydration gives a clear account of Werner's Co-ordination Theory. In Chapter XIII are considered the stereochemical aspects of valency, and it is shown how the wavemechanical treatment of valency angles has justified the pure chemist's sound instincts, as witness the phenomenon of d^2sp^3-hybridisation leading to Werners's hypothesis regarding the stereochemistry of hexavalent complexes. The last chapter, XIV, is a short discussion of the electronic theory of acids and bases.

This little book of only 159 pages is neatly printed and got up, and except for an obvious error in the structural formula for the sodium derivative of benzoyl acetone on page 135, is free from mistakes. It is moderately priced and should provide a very good supplementary

reading to undergraduates as well as to others who desire to become acquainted with the recent advances in this field.

M. A. G.

The Rayon Industry, Possibilities of its Establishment in India. (All-India Manufacturers' Organisation Monograph No. 4, Bombay), 1944. Pp. 25.

This pamphlet advocates the early establishment of a factory for the production of Artificial Silk by the viscose process, in India. The statistics given show that this country imports or was importing in 1937-39, 50,000,000 lbs. rayon per year, a considerable portion of which, in the form of rayon and staple fibre, was used up by our great textile industries. This dependence of a key industry for an important product on foreign supplies, is to say the least, not healthy. The pamphlet indicates very briefly the prospects for the establishment of such a factory in terms of availability of raw materials, such as wood and bamboo pulp, cotton linters, and short-staple cotton, plant location, chemicals required, technology of production, labour and management, daily capacity (10 tons), investment required (one crore rupees) and profits (a safe minimum of 20 per cent.).

M. A. G.

Soil and Plant Analysis. By C. S. Piper. (The University of Adelaide, South Australia), 1942. Pp. x + 368, Illustrated. Price 15*s*.

This book is a monograph from the Waite Agricultural Research Institute. It brings together in one volume, the more important and the more widely used analytical methods for soils and plants.

About the beginning of the present century H. W. Wiley published his *Principles and Methods of Agricultural Analysis* in three volumes. Later Klein in his four volumes of *Pflanzenanalyse* has brought together and dealt with in considerable detail the methods and techniques scattered over a large number and variety of periodical publications. The Association of official Agricultural Chemists in U.S.A. has been rendering yeoman service to their fellow-workers in America and elsewhere by publishing a journal and by issuing from time to time revised editions of their well-known publication *Official and Tentative Methods* which is in use in the laboratory of every agricultural chemist.

With the development of soil and plant research in geographical extension, the need has been felt to modify methods of analysis to suit special requirements of particular localities, materials and laboratories. To this end workers in India, Australia and Africa published from time to time several modifications of well-known methods. As far back as 1928 Dr. J. A. Prescott of the Waite Agricultural Research Institute published a bulletin in the series of publications, issued by the Commonwealth Council of Scientific and Industrial Research, Australia, dealing with soils. Dr. Piper who has been long associated with Dr. Prescott has, in the publication under review, reproduced the methods of soil analysis previously described in the aforesaid bulletin and has also added a good deal of other selected data in the first part. In the second part he has furnished *valuable* information in regard to the inorganic constituents of plants and their methods of determination.

Information on the subject of trace or minor elements and their bearing on soil and plant nutrition is widely scattered among a number of publications. Dr. Piper has collected the relevant information and presented it in a readily accessible form. Dr. Piper has not included (and in the reviewers' opinion rightly) a chapter on rapid methods of analysis and on foliar and other diagnostics of plant and soil deficiencies, presumably because their usefulness in soil fertility investigations is not yet established for inclusion in a book of the kind meant as a laboratory companion for agricultural workers.

The book is attractively got up and is free from mistakes. It should prove a useful addition to the library of an agricultural chemist.

B. V. N.

STARCH AND ITS DERIVATIVES*

THE second edition of the monograph on starch will be warmly welcomed, if only because the revision has vastly improved the intrinsic value of a work of acknowledged merit. Owing to the dislocation of normal trade channels due to the present emergency, the requirements of essential industrial products have to be met by stimulating indigenous production. This is particularly true in India with a gigantic textile industry consuming large quantities of starch and a series of its derivatives. The position is particularly critical as the accepted sources of starch, *viz.*, cereals and tubers, constitute valuable items of food which have to be conserved for human consumption. The position demands careful and informed consideration at the hands of technologists. The appearance of a monograph summarizing the latest developments in an important branch of chemical industry and presenting a very balanced account of the scientific and technological researches should be considered very opportune.

The beginnings of the starch industry date back to the earliest periods of recorded history. The discovery of dextrin, reminiscent of Lamb's account of the roast pig, extended the field of industrial application of starch. The more recent studies on the derivatives of starch, notably on the ethers and esters, have opened up new industrial possibilities. On the vexed question of the structure of starch itself, the

* "Starch and Its Derivatives", by J. A. Radley. (Chapman & Hall Ltd., London.) Second Edition (revised). 1943. Pages xii + 558; Price 36/-.

recent work of Hanes (1940) has provided a decisive answer and a rigorous explanation of a vast array of observations by numerous investigators is now possible. The story of starch, comprising the historical, scientific and technological aspects, has been told in this monograph in great detail and with amazing accuracy. The monograph provides valuable information and serves as a stimulus to research workers engaged in the study of the chemistry of starch and industrial applications.

To comprehend the scope of the technology of starch, it is necessary to mention that straight and modified starches and starch derivatives, find application not only in several major industries, such as textile, paper, laundry, fermentation and food industries, but also the demands of each industry are very varied and exacting. A few instances may be cited to serve as illustrations. For the surface sizing of paper, fluid pastes are required but for securing stiffness and for formation of the multilayers a viscous adhesive is demanded; the confectionary industry demands what is called "clear gum" which will not become opaque on ageing; adhesives for stamps, envelope flaps and labels, which come into contact with the tongue, should be tasteless and odourless; pastes for cigarette papers should emit no smell, nor impart any taste when "smoked", nor should the paper pucker when the paste is applied; adhesives for labelling tins should wet and penetrate the grease with which the tin surface is smeared in order to be effective; laundry stiffening mixture should be such that when ironed or calendered the fabric should take a high gloss; in coating labels, the pastes should be smooth so as to facilitate application by machinery on a mass production scale. These and numerous other requirements, exacting as they are, have been met through careful laboratory investigations. The theoretical principles which form the basis of the applications, have been adequately explained in the monograph and this constitutes, perhaps, its most conspicuous feature.

A study of the various chapters comprising the book, reveals that notwithstanding the large amount of work carried out, there are important gaps in our knowledge of the chemistry and technology of starches. The book poses several problems for solution and the discerning reader will find enough material on which he can exercise his thought and make new discoveries of profound significance. In considering such possibilities, he will obtain ample guidance and inspiration from the spectacular developments in the field of cellulose chemistry. The fundamental difference between starch and cellulose lies in the circumstance that the glucopyranose residues in the former are united by 1 : 4-α linkages, while in the latter the union is through 1 : 4-β linkages. This difference manifests itself in the granular and fibrous structures of starch and cellulose respectively. Both starch and cellulose yield analogous derivatives, *e.g.*, nitro-derivatives, acetates, ethers, esters and xanthogenates, with differences in properties attributable to differences in structure. Nitrostarches can be employed as explosives. Acetates find use in the production of transparent elastic films. Benzoylated starches can be suitably processed to yield glossy, resinous products soluble in acetone, alcohol and aromatic hydrocarbons. Despite the developments already made, the possibilities of the derivatives of starch remain yet unexplored.

The descriptions of the methods of manufacture of root and cereal starches are critical and informative. Photographs of the machinery employed are provided and the different stages of manufacture are indicated by flow diagrams. Those who are interested in the development of the starch industry in India will find in Part 2 of the monograph ample material of immediate value. The organization of the starch industry on rational lines is an urgent necessity in India, particularly in view of the existence of a big internal market. The production of raw materials, their processing and the manufacture of starches and their derivatives demand planned development.

The author has secured the co-operation of a number of experts—Prof. E. L. Hirst, Dr. G. T. Young, Mr. G. V. Cæsar, and Prof. F. F. Farby —in the compilation of the book. He is entitled to the gratitude of a large number of readers for the critical appraisal and a masterly exposition of the latest developments in an important field of chemical industry.

B. N. Sastri.

SCIENCE NOTES AND NEWS

Portraiture in Ancient Egypt.—Dows Dunham, in an illustrated article in the *Bulletin of the Museum of Fine Arts*, Boston, XLI, No. 246, December 1943, discusses whether some of the well-known Egyptian sculptures of the Fourth Dynasty cannot be regarded as portraits in the modern sense. Modern portraiture at its best seeks to represent by lines or colour, the physical and spiritual features of the subject, as interpreted by the artist. It is difficult for us in the twentieth century to visualize men of the 27th century B.C. as living personalities. A portrait to ancient Egyptians served ritual, but not artistic, ends, and the result was that, except in special cases, the sculptures were stylised and stereotyped. But occasionally, when the man for whose spirit's shelter the effigy was fashioned happened to be of high status, the artist's work became portraiture revealing personality and individual characteristics. Eight sculptures from Giza in the Museum of Fine Arts at Boston are discussed in the paper, *viz.*, (1) the head of an unknown prince sculptured with exquisite skill in white

limestone; (2) a princess with Negroid features; (3) a high official, "Overseer of the two Houses of Silver"; (4) the same in relief; (5) bust of Ankh-haef, the vizier; (6-8) figures of King Mycernius as a youth, as a mature person, and with his queen. According to the author, "the bust of Ankh-haef' is the supreme example of realistic portraiture which has survived from ancient Egypt, alike for its freedom from convention and for its freedom of execution". This figure is also as usual in white limestone, covered over with plaster of Paris in which, while still wet, finer details have been worked and later painted brick-red all over including the head.

A. AIYAPPAN.

A rich prehistoric microlithic and bone industry, besides remains of several partly fossilized mammalian bones and three incomplete human skeletons, have been discovered in Gujarat by the Second Gujarat Prehistoric Expedition organised by the Director-General of Archæology in India.

The discovery of so many human and animal remains and a bone industry comprising tools and articles of decoration, such as beads, in association with microliths, is the first of its kind in India. It may lead to results of the greatest importance for the study of early man in India.

The expedition worked with the co-operation of the Director, Deccan College Post-Graduate and Research Institute, Poona, and the staff of the History Department. It has been conducting excavations at Langhnaj, Mehsana Prant, Baroda State (Gujarat).

In the course of his budget speech to the Central Legislative Assembly (29th February 1944), the Hon'ble Sir Jeremy Raisman said:—

"In connection with industrial research we have made provision for a grant of Rs. 10 lakhs for the construction and equipment of glass and fuel research laboratories and for general planning for other institutions. *The Council of Scientific and Industrial Research* has done valuable work within the limits of the funds allotted to it by Government, and the Government of India have now agreed to the *Council* drawing up plans for co-ordinated scheme for the advancement of research on the assumption that Rs. 1 crore will be forthcoming towards capital expenditure on a chain of research institutions. The institutions in contemplation, in addition to the two I have mentioned, are a National Physical Laboratory, a National Chemical Laboratory and a National Metallurgical Laboratory. The balance of Rs. 1 crore will be spread over a period of three or four years after the cessation of hostilities. This step will, I am sure, be regarded as a practical expression of Government's resolve to foster the development of Indian industry and should, at the same time, serve as an incentive to private enterprise to come forward and support industrial research. A handsome beginning has already been made by the Tata Trust, whose enlightened liberality in matters of this kind I gladly take this opportunity to acknowledge; they have now increased their promised donation of Rs. 8·30 lakhs towards a National Chemical Laboratory by a further Rs. 11·70 lakhs towards the proposed National Metallurgical Laboratory, making Rs. 20 lakhs in all."

Addressing the Convocation of the Calcutta University on the 4th March 1944, Sir S. Radhakrishnan, Vice-Chancellor of the Benares Hindu University, pleaded for priority for education among the schemes now being considered. He said, "The war has exposed the weakness of our Government, our economic life and our system of education. The death due to famine conditions of a million people, even if we accept the figures given by the Secretary of State for India in the Commons, is not essentially different from or less costly than the death of a million people in any other part of the world. If we realise what this means in terms of human suffering and sorrow, we should be filled with shame and resentment, and a burning desire to wipe out the conditions which make such things possible.

"A well-planned and vigorous economic expansion, involving the introduction of modern technical and industrial methods of producing goods and services, an all-out development of education and public health alone can give relief to a long-suffering people and restore national vitality. ... Social security, communications, health and sanitation, were all important but education which was concerned with the making of man was the most important. The Sargent Scheme gave a comprehensive plan of education for all stages from childhood to maturity and attempted to make the educational system organic to the community. It was a long-term national enterprise and its full realisation would take at least a generation and demand the sustained efforts of the community and the effective co-operation between the Government and the other agencies. If India was not to lag behind other progressive countries, the scheme should be put through."

In the course of his presidential address to the Academy of Indian Medicine, Captain G. Srinivasa Moorthy emphasized the need to provide for the study of Indian medicine in any scheme of medical education that might be planned for India. A unified scheme of medical studies was urgently needed, and it was desirable that every allopathic practitioner seeking to practise in India, should be required to have a working knowledge of Indian medicine to which about 90 per cent. of the population resorted for relief. The Madras Government had already instituted post-graduate courses in Indian Medicine lasting two years and open to qualified practitioners of allopathy. A study of Indian medicine should also be included in the curriculum of studies of allopathic institutions.

An Indian Scientific Mission led by Sir S. S. Bhatnagar will shortly leave for England under the ægis of the Central Government to study the working of scientific research organisations there in relation to the war effort. The delegation includes Sir J. C. Ghosh, Prof. M. N. Saha, Sir P. M. Kareghat, Dewan Bahadur

Dr. A. L. Mudaliar, Col. S. L. Bhatia and Prof. S. K. Mitra.

A scheme to train promising young Indians in the United Kingdom for technical posts of Officers' status is now under consideration of the Government of India.

On the basis of returns from factories, the Director of Imperial Institute of Sugar Technology estimates the production of sugar from cane at 1,205,300 tons as against an actual output of 1,070,700 tons in 1942-43 season.

In connection with post-war planning, Mr. J. S. Bolton, Financial Secretary to the Government of Sind, has been appointed Financial Adviser to the Government of India, Post-War Development Department. Mr. Sen Gupta, Financial Adviser to the Communications Department, has been deputed to plan post-war schemes for the Post and Telegraphs Department and he is expected to submit his report by the end of May. Sir Feroz Khareghat, Vice-Chairman of the Imperial Council of Agricultural Research, has been entrusted with the task of preparing a memorandum on the general lines which post-war agricultural planning should follow.

The Raja of Munagala has donated Rs. 17,500 to the Andhra University to institute the "Raja of Munagal's Emperor Krishna Deva Raya Research Fellowship" to promote research into South Indian Archæology, History and Culture with special reference to Andhras and including Andhra Colonies in the Pacific and the Far East.

The Council of Scientific and Industrial Research has agreed to Sir S. S. Bhatnagar's proposal to split the Laboratories of the Board of Scientific and Industrial Research into two sections—a chemical laboratory and a physical laboratory—with a view to facilitate their amalgamation respectively with the National Chemical and the National Physical Laboratories, the plans of which have already been drawn up. Dr. S. Siddiqui will be placed in charge of the chemical section while Dr. Lal C. Verman will be responsible for directing the work of the physical section.

The Council of Scientific and Industrial Research has accepted the suggestion made by Prof. M. N. Saha and Dr. C. W. B. Normand, to institute an Atmospheric Research Committee.

The Government of Madras have sanctioned the extension of the Agricultural Research Station at Pattambi (Malabar) at a cost of Rs. 1,47,100. About seventy acres of land adjacent to the Farm have been acquired. The Station will increase the supply of improved strains of paddy.

The Government of Madras have approved a non-recurring initial expenditure of Rs, 75,000 for the construction of buildings, static tank, etc., and for the purchase of instruments and equipment, in connection with the formation of an Irrigation Research Station at Poondi.

The Secretary, Vincent Massey Scholarship Selection Committee, 5, Russel Street, Calcutta, announces that applications for the scholarship should reach him not later than June 1, 1944. The scholarship tenable for a year at the University of Toronto for post-graduate work, will be awarded by H. E. the Viceroy, on the recommendation of the Selection Committee.

Mr. M. Rahimullah Quraishi of the Osmania University has been awarded the degree of D.Sc. of the Madras University on the thesis entitled "A Comparative Study of the Morphology, Histology and Probable Functions of the Pyloric Cæca in Indian Fishes, together with a Discussion on their Homology". This thesis was supplemented by a dozen other original papers on similar problems.

The Government of India have sanctioned a scheme for the Imperial Dairy Department by which the Imperial Dairy Research Institute at Bangalore will be taking two honorary research workers from July 1944 for carrying out advanced research work for a period of one year. The problems for research will be confined to those bearing on the Chemistry and Bacteriology of milk and milk products, Technology of milk processing and manufacture of milk products and Cattle Husbandry coming within the purview of the present activities of the Institute. The workers will be exempt from payment of any fees but subject to the other conditions and rules of discipline prescribed at the Institute. They will also have to make their own arrangements for boarding and lodging. The candidates will have the facilities for doing post-graduate work for the M.Sc. and PH.D. degrees of the Bombay University and other Universities by whom the Institute has been recognised as a suitable centre for the purpose. Intending candidates, who are graduates of Indian or European Universities, and preferably with First Class M.Sc. or B.Sc. Honours qualification may apply to the Director of Dairy Research, Bangalore, at an early date giving full particulars of their age, qualifications, research experience, nature of problem desired to be studied, etc., etc.

The National Chemical Laboratory.—A scheme for the establishment of a National Chemical Laboratory for India after the war has been drawn up by a committee of the Council of Scientific and Industrial Research. The Laboratory is intended to specialise in industrial research and develop new processes up to the pilot plant stage.

"The proposed National Chemical Laboratory in India is expected to follow, more or less, the lines which have been accepted for the chemical research laboratories in Teddington (London), although the technical nature of our problems may be somewhat different owing to our special needs.

"It has to be borne in mind that while fundamental problems in various branches of chemistry will be promoted and encouraged as no new industrial work of any importance is possible without the researchers being engaged in increasing the bounds of fundamental knowledge, greater emphasis will be laid in this Laboratory on industrial research and the development of new processes up to the pilot plant stage, so that the chemical industry and other industries requiring the aid of chemical research in general will benefit from the investigations carried out in this Laboratory.

"In India such facilities for research work up to the pilot plant stage are rarely available and such scientific research as had been carried out so far has not been so convincing to industrialists and the would-be manufacturers as it might have been if the success of a process had been demonstrated on a large scale.

"This aspect of the question will distinguish the National Chemical Laboratory from the rest of the laboratories either in the universities or in any technical institution run privately, or under semi-Government control. It will maintain the closest co-operation with existing institutions, particularly as the National Laboratory will be able to initiate those ambitious investigations which are not carried out in university laboratories either for want of funds or for the reason that the problems have a predominantly industrial bias."

It is proposed that the Laboratory should, at present, provide accommodation and facilities for the following main branches of chemistry: Inorganic Chemistry, including analytical investigations; Organic Chemistry, including drugs and chemo-therapy; Physical Chemistry, including high-pressure technique and electrochemistry; Bio-Chemistry, including biological products and chemical engineering.

With a proper co-ordination of the activities of these sections, it will be possible, the report states, to deal with new raw materials and problems relating to a number of industries, such as heavy chemicals (acids, alkali, salts, etc.); minerals, particularly from the analytical standpoint, and such industries as the non-metal industries: fertilisers, organic and inorganic chemicals, including solvents, pharmaceuticals and food; fermentation and biological products; resins and plastics; paints, pigments, lacquers and varnishes; oils, fats, soaps and lubricants; essential oils, rubber, petroleum, high-pressure research and electro-chemical industries.

The workshops and pilot plant equipment suggested for the Laboratory ought to enable the Laboratory to undertake, ordinarily, any type of industrial research.

Public opinion on the tentative scheme is invited. Scientists and scientific bodies and commercial men and commercial bodies interested in the proposals will be supplied with copies of the scheme, on request, by the Director of Scientific and Industrial Research, University Buildings, Delhi.

MAGNETIC NOTES

Magnetic conditions during March 1944 were more disturbed than in the previous month. There were 10 *quiet* days, 20 days of *slight* disturbance and 1 day of *moderate* disturbance as against 8 quiet days, 20 days of slight disturbance and 3 days of moderate disturbance during the same month last year.

The quietest day during March 1944 was the 17th and the day of the largest disturbance the 4th.

The individual days during the month were classified as shown below.

Quiet days	Disturbed days	
	Slight	Moderate
2, 3, 5, 15–17, 20, 21, 23, 24.	1, 6–14, 18, 19, 22, 25–31.	1

No magnetic storm occurred during the month of March 1944 while one moderate storm was recorded in March last year.

The mean character figure for March 1944 was 0·71 as against 0·84 for March 1943.

A. S. CHAUBAL.

We acknowledge with thanks receipt of the following:—

"Journal of the Royal Society of Arts," Vol. 92, Nos. 4655-56.

"Journal of Agricultural Research," Vol. 67, Nos. 7-8.

"Journal of Chemical Physics," Vol. 11, No. 11.

"Experiment Station Record," Vol. 89, No. 6.

"Indian Farming," Vol. 4, No. 9.

"Transactions of the Faraday Society," Vol. 39, Pt. 12.

"Indian Forester," Vol. 70, Nos. 2-3.

"Indian Central Jute Committee Bulletin," Vol. 6, No. 11.

"Indian Medical Gazette," Vol. 79, No. 2.

"The Review of Applied Mycology," Vol. 22, No. 12.

"American Meteorological Society Bulletin," Vol. 24, Nos. 7-8.

"Nature," Vol. 152, Nos. 3870-71.

"American Museum of Natural History," Vol. 52, Nos. 4-5.

"Science and Culture," Vol. 9, No. 9.

BOOKS

Climate and Labour. By W. Burridge. (Kitabistan, Allahabad), 1944. Pp. 167. Price Rs. 5-4-0.

Pollen Analisis. By G. Erdtman. (Chronica Botanica, Waltham, Mass., U.S.A.; Calcutta: Messrs. Macmillan Co.), 1943. Pp. 289. Price 5 dollars.

Soviet Russia, the Secret of Her Success. Edited by K. S. Hirlekar. Avanthi Prakashan, Bombay), 1944. Pp. 391. Price Rs. 6-8-0.

371-44—The Bangalore Press, Bangalore City, by G. Srinivasa Rao, Superintendent, and Published by Dr. M. A. Govinda Rau, M.A., Ph.D., for The Current Science Association, Bangalore